Air-conditioning in the Magma copper mine at Superior, Ariz., brought about a change in the underground pumping system, it proving better to remove the total mine water, warmed as it is in the condenser, in one high lift through an upcast shaft than in three lifts through a downcast shaft, which was the practice prior to the change. E. E. Slack, mechanical engineer for the company, will tell the story next month.

▼

Resistance of different forms of timbering to the flow of air in a two-compartment shaft has been studied at the University of Utah, under the direction of R. S. Lewis, professor of mining, with the aid of a model built on a scale of 1 to 12. The work and its results will be described by the researchers in an early issue.

▼

Television, as now made possible, promises a new outlet for nickel, according to R. C. Stanley, chairman of Canada's great producer of that metal, in a recent statement to shareholders. Vital as the device that translates the electrical impulses into visual patterns, the cathode-ray tube may require up to eight times as much nickel in its construction as does the conventional wireless tube. Associated with it in the receiving set are 18 to 36 radio tubes, as compared with the 4 to 16 employed in the modern wireless set. The metal and its alloys are also used in the transmitting equipment.

▼

Nickel likewise is the material from which the "world's smallest" tube is made. On exhibit at the New York Fair, this is as small as a human hair and has a hole only 0.0007 in. in diameter. Enough of it to weigh one pound would be 11 miles in length.

▼

Defender of aluminum in cooking utensils is the rôle assumed by the Federal Trade Commission in issuing a complaint against a Scranton company and its president for allegedly publishing statements that tend to make the public think that such utensils menace the health of users. In truth, the Commission states, they are not unsafe for mankind when properly used in preparing or keeping foods. What has been a well known fact is about to be redemonstrated.

Suggestions made by General Electric employees submitting new ideas brought them the sum of $32,570 in special payments in the first half of 1939. The ideas turned in totaled 15,407; 5 304 were adopted.

H. C. PARMELEE
Editorial Director

Engineering and Mining Journal

H. W. CLARKE
Vice-President

Published by McGraw-Hill Publishing Co., Inc.

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Published monthly. Subscription rates: United States and Canada, $3 per annum; other countries in the Americas outside the United States and Canada, $4 per annum: elsewhere $5 or 20 shillings per annum. Price per copy 50c. or 2s. Entered as Second Class Matter September 18, 1936, at Post Office, Albany, N. Y., under Act of March 3, 1879. Printed in U. S. A.

Cable Address: New York McGraw-Hill, N. Y.

McGRAW-HILL PUBLISHING COMPANY, Inc.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office, 99-129 N. Broadway, Albany, N. Y.

McGRAW-HILL PUBLISHING COMPANY, LTD.
Cable Address: Backlash, Estrand, London
Aldwych House, Aldwych, London, W. C. 2, England

Editorial and Business Offices: 330 W. 42d Street, New York City, N. Y.
San Francisco, 68 Post Street, Room 503; Chicago, 520 N. Michigan Avenue; Washington, D. C., National Press Building

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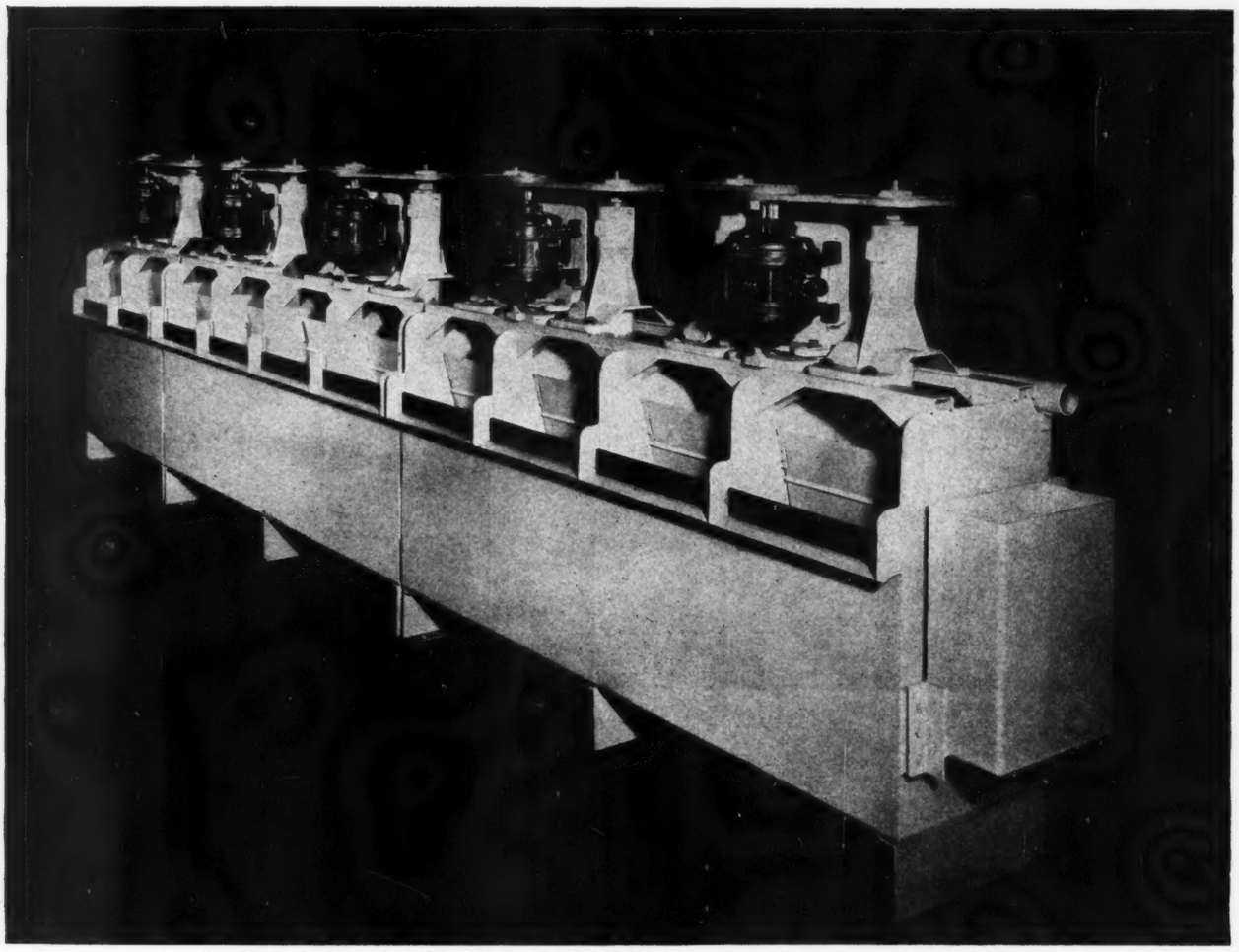

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Engineering and Mining Journal

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Volume 139 Number 9

SEPTEMBER 1939

War and the Markets

ONCE AGAIN war grips Europe and the world. For millions of people the normal pursuits of life are already yielding to regimentation and discipline vital to the success of arms. Much was learned from the last conflict, and, in the countries affected, industry is even now entering upon a period of rigid control for the common good. Democracies at war must of necessity clothe themselves in the garb of the totalitarian State if they would contend with an enemy of the latter type effectively. Even neutrals may find it advisable to adopt measures of control, if only to avoid the business boom that may be followed so quickly by collapse, after causing wages to skyrocket and plant capacity to expand unwisely, should the conflict suddenly end.

The extent to which the non-ferrous metal industries, in both belligerent and neutral countries, are likely to be affected cannot yet be seen. The prospective duration of the war will be a factor. Should the conflict be short, the stocks of metals now on hand may prove ample. Buying by European countries in the danger zone has exceeded requirements for several years. Apparently, nowhere at the moment is there a real shortage of the raw materials called for in time of war. In any case, unusual conditions unquestionably lie ahead, in the industry and the markets. The control boards already set up in most industrialized countries to insure the steady flow of essential supplies will have their effect. Profiteering is not likely to be tolerated. Price fixing at reasonable levels is expected and speculation will be frowned upon. Such a situation is apparently taken for granted by the producers, among whom the dominant thought seems to be, can the economic system survive another major clash?

At the same time, it is expected that war activity will result in extra demands on the non-ferrous metals industries and that those commodities that are underpriced will advance sufficiently to provide adequate supplies. But a runaway market is hard to visualize under the conditions that obtain.

As the recent events swung the world from peace toward war, the metal markets behaved as might have been expected. Normal functioning declined late in August with the fading hope that hostilities might possibly be avoided. The first reaction of buyers and sellers to the unfavorable turn abroad was one of bewildered helplessness. Up to then each group had refrained from taking a definite stand in the market. Subsequent action of the major metals in New York, however, was quite encouraging, copper, lead and zinc advancing moderately. Abroad, the pound sterling broke and sterling equivalents dropped, gold in London touched a new high at 168s. an ounce, and the Government of South Africa moved to take the proceeds above 150s. realized from the sale of gold. The London Metal Exchange was closed. Meanwhile the buyer had to assume all risks on export business booked in New York and war insurance rates were raised.

At the moment the neutral world is waiting for things to happen. Prophecy is vain and forecasts are foolish. One can only hope that order will soon be reestablished.

American Peace

NEVER have the peace and amity prevailing among the nations of the Americas seemed more worth preserving than today, when, in terrible contrast, loom the possibilities of the new war that is already being waged in Europe. Isolation of the New World or of any country in it is as impossible as it is undesirable; yet efforts can be made to prevent a spread of the contagion to this Hemisphere and to further good relationships between the friendly peoples that dwell in it. Wars here have occurred indeed at times, but the pages of Western history are not beclouded with long centuries of suspicions and ill feelings, marked with memories of strife and injuries. For this the Western World is far too young. Here the traditional enemy does not exist and there is room for all to live. Here each country is endowed with resources that should enable its citizens at least to dwell in comfort and which, perhaps with judicious aid, can be made the basis of prosperity that will insure well-being for the future. In such a fortunate part of the world, it ought to be possible to reconcile in quiet conference all

differences that may arise between peoples, and good-neighborliness should indeed be the order of the day. By whatever means, disputes should be quickly settled and the causes of disputes removed.

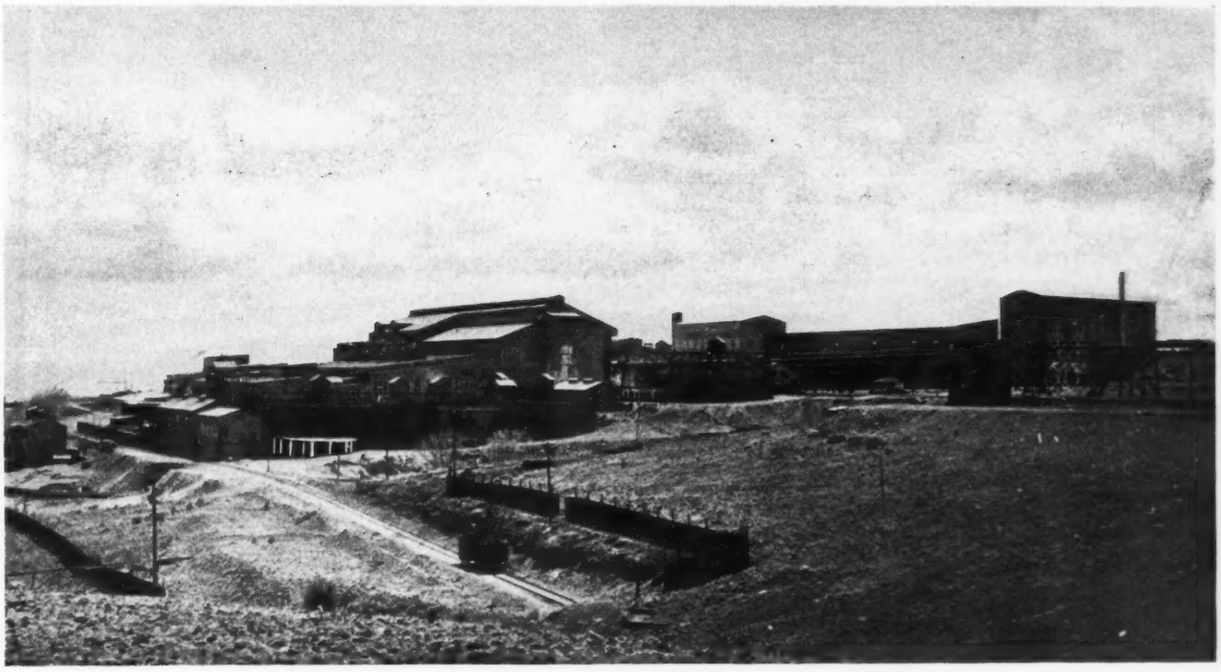
Tending to disrupt good relations between certain nations has been the expropriation of foreign-owned properties, coupled with the failure to make prompt and adequate payment for them as international law provides. The irritation that naturally occurs when an instance of this sort arises is heightened by the fear that the example may be copied and the incident become a practice, and that in general foreign investments may become endangered. No argument, however clever, can appease the individual, company, or nation that finds itself deprived of legally acquired possessions and rights without immediate and just compensation. From such occurrences spring ill will and from ill will eventually conflicts, of varying degree. Expropriation, so heedlessly carried out, is born of thoughtlessness, and conceived in disregard of the almost certain outcome. It cannot but bear evil fruit for those responsible. It is, in short, lawlessness that wise statesmen will avoid.

The causes that breed the desire to expropriate the property of foreigners have their roots in nationalism which, in turn, flourishes best when times are hard. This wave of economic nationalism evident in some countries, says Mr. Otto T. Kreuser, vice-president of the Chase bank, in *The Annals* of the American Academy of Political and Social Science for July, "is based on the concept that foreign capital, and especially foreign management, has tended to develop the resources more or less exclusively for the profit of the foreigners and that a relatively unimportant share of the benefits has accrued to the economy and population of the countries concerned. But in most cases, foreign interests can demonstrate to the satisfaction of these people that this is not true. . . . When a reasonable point of view is taken, the wholesale agitation against foreign development of the countries' resources breaks down." And Mr. Kreuser adds: "This unfortunate feeling against development by foreign capital will also become less active as local capital is able, over a period of time, to share with foreign capital in local economic developments."

To allay this feeling and at the same time avoid loss to the foreign investors who at present cannot help but be apprehensive of possible new expropriations would seem an object worthy of an effort. It would, moreover, be desirable to have the foreign field regain its former attractiveness as a safe place for putting surplus capital to work. Estimates vary as to the size of the stake held by United States citizens and companies in Latin America. They agree, however, that the total of direct long-term investments is well in excess of $2,000,000,000, the bulk of this being in Cuba, Mexico, Chile, Argentina, and Brazil, in the order of their respective shares. This huge sum has gone into developing the mines, railroads and utilities, and the varied industrial enterprises, of the countries named. It is unthinkable that so great an investment, made in the first place with the consent of the respective Governments of these countries, should be allowed to come into jeopardy, productive as this would be of endless disputes and quarrels. The suggestion made by Mr. Kreuser, that local capital be allowed to share with foreign capital in local economic developments, is worthy of consideration. Wherever this were done, it is reasonable to believe the local attitude, if previously hostile, would soon begin to change. The foreign enterprise would now have friends in the country where it found itself and their number would depend upon the extent of the local participation.

It so happens that a plan that would help bring about this happy change has already been devised by Mr. Howland Bancroft, who describes it elsewhere in this issue (pages 35 to 37). Years of experience in various Latin American countries give Mr. Bancroft's words authority. Successful application of the formula he proposes should tend to protect the investment of the foreigner by making the enterprise to which it is applied a local one, with local investors ready at any time to champion its use in the country's courts or at the polls. As Mr. Bancroft states, the plan has already been applied in the case of a public utility in one of the Latin American States. And lest the difficulty of transferring earnings and other funds abroad, arising from an inadequacy of the amount of foreign exchange available, should serve to discredit the plan with some, Mr. Bancroft makes a further interesting suggestion as to creating additional exchange through applying such funds to developing new exports, under agreement with the local Government that at least part of the exchange thus secured could be retained by the producer. This scheme, be it noted, has already been adopted in one of the Republics to the South in connection with a commodity hitherto unexported by that country.

Some solution to the growing problem of expropriation, existing and threatening, must be found that is just and satisfactory to all the interests involved. The course it prescribes must lead away from intrigue and violence and toward closer friendly ties and better understanding. Thus can long continuance of American peace and prosperity be assured.



Chino's concentrator and crushing plants. The mill flowsheet has recently been simplified

Chino Today

Erection of a new copper smelter and installation of equipment for recovering molybdenum from the ore are among the changes recently made

John B. Huttl
Assistant Editor

LATE IN MARCH, 1939, I had the privilege of visiting the Chino operations of the Nevada Consolidated Copper Corporation, subsidiary of Kennecott Copper Corporation, at Hurley and Santa Rita, N. M. Both properties, the mine at Santa Rita and the concentrator and recently completed smelter at Hurley, some 9½ miles apart, are served by a branch line of the Santa Fe railroad connecting with the main line at Deming, N. M., about 40 miles south. The district is easily accessible over excellent highways either via Deming or by the Lordsburg-Silver City route, which is shorter but involves travel over about 43 miles of unpaved road. Silver City is about 18 miles west of the mine. Elevation at Hurley is 5,700 ft.; that at Santa Rita is about 600 ft. higher. The topography near the mine consists of a series of high hills with narrow creeks between. The climate is typical of that prevailing in the Southwestern mountain regions.

Copper mining in the Chino area was initiated before the beginning of the last century, with the first regular operations being started by the Spaniards at the Santa Rita del Cobre mine in 1804. Nearly all evidence of these and later workings by different owners has long ago been eliminated by the large-scale operations started in 1909. The colorful history and subsequent development of the Chino enterprise are covered in a series of excellent articles by T. A. Rickard (*E.&M.J.*, Vol. 116, Nov. 3, Nov. 10, Dec. 10, and Dec. 29, 1923, and Vol. 17, Jan. 5, 1924). Save for some brief shutdowns dictated by poor market conditions, production has continued ever since 1909. With it, a progressive management has periodically improved operations and effected material cost reductions by adopting new working methods and installing more efficient equipment as they became available. During the last two years in particular many changes have been made at Hurley as, for instance, the erection of a new primary crushing plant at the head of the concentrator (crushing was previously done at the mine), simplification of the mill flowsheet, development of a molybdenum recovery plant, and construction of a modern smelter. Natural gas is now used almost entirely in the different departments. In this article I shall present details of current practice and describe some of the recent plant improvements.

The mine at Santa Rita is a chain of large open pits, elliptical in shape, worked by bench methods. Breakage of the porphyry ore in advance of the power shovels is accomplished principally by putting down blast holes, using electric churn drills. For loading and drilling operations there are available at the pit 12 electric shovels of 4-, 5-, and 8-cu.yd. capacities, and 13 electric drills and 1 gas churn drill. The diameter of the churn-drill bits has recently been increased from 6 in. to 9 in. Bench heights are kept at about 42 ft. All blasting is done by electrical methods. Broken ore is loaded by the shovels into 75-ton steel cars and hauled by steam locomotives to the point of

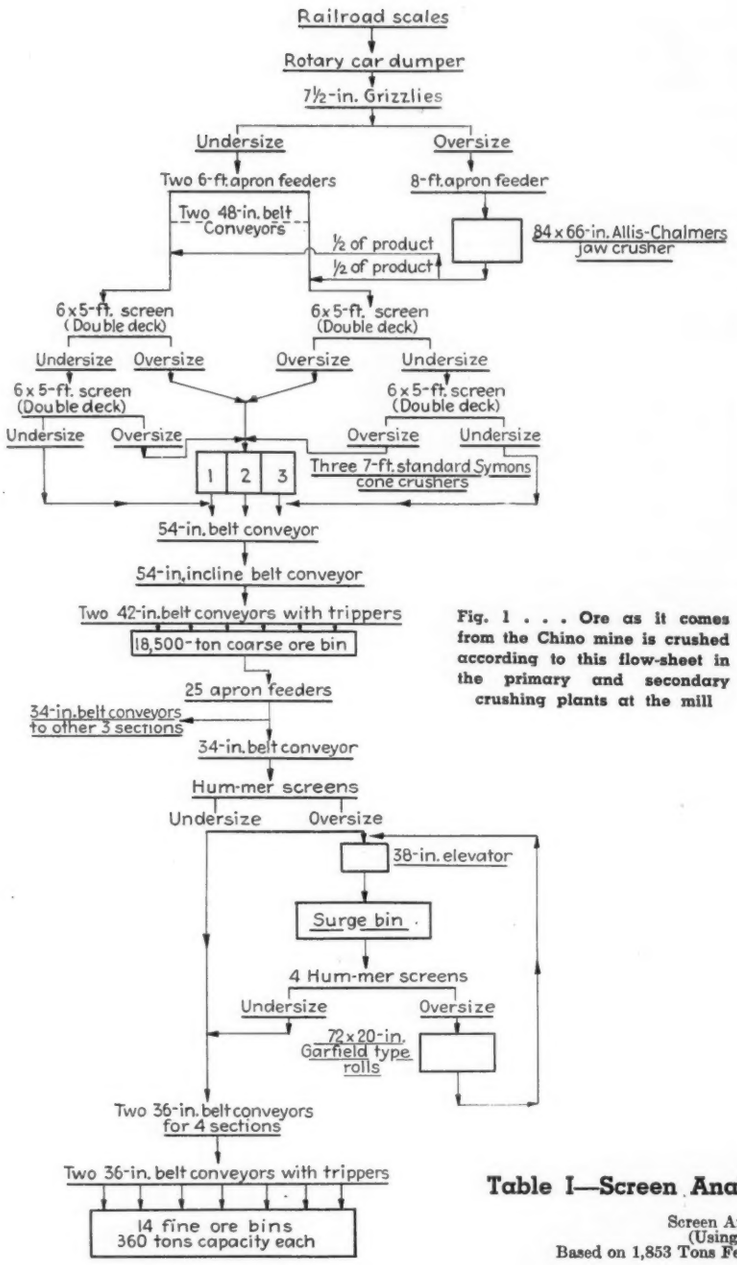


Fig. 1 . . . Ore as it comes from the Chino mine is crushed according to this flow-sheet in the primary and secondary crushing plants at the mill

transfer a short distance from the entrance of the pit, whence it is transported to Hurley by the Santa Fe under tariff. Trackage used throughout the pit is made from 75- and 85-lb. rail. Since completion of the new coarse crushing plant at the concentrator all crushing operations have been discontinued at the mine, and the old plant west of the pit has been dismantled. The repair shops, substation, drill sharpening shop, air compressors, and store building are close to the entrance of the pit. All structures are connected by an efficient track system, and available electric cranes facilitate rapid and safe handling of materials and machinery parts to be changed or repaired.

The new coarse-crushing plant at Hurley establishes a standard. No efforts have been spared by the management and the engineering department to make the unit efficient and safe. The building proper is of reinforced concrete, with a steel railroad trestle traversing the head or upper part containing a rotary car dumper. Its interior is well lighted by a generous number of large windows, and the efficiency of the dust-recovery plant is evinced by the absence of dust. The different operating floors are served both by a steel stairway and an elevator. All crushing, screening, and conveying machines are so grouped as to make them easily accessible if in need of repair. Plant operations are regulated from a central control and observation booth installed between the car dumper and the jaw crusher. Fig. 1 shows the treatment the mine-run ore undergoes at the coarse-crushing plant. The 75-ton cars, weighed previously on railroad scales, are dumped by rotary dumper onto grizzlies with 7½-in. openings, the oversize going via an 8-ft. apron feeder to an 84x66-in. jaw crusher, while the undersize is directed by two 6-ft. apron feeders and two 48-in. belt conveyors to two 6x5-ft. double-deck vibrating screens with 2½x2½-in. openings on the top deck and 1x2-in. openings on the lower deck. These units also receive the minus 8-in. crusher product, which goes in equal proportions to the duplex conveying system handling the grizzly undersize. The screen oversize is reduced to minus 1 in. in three 7-ft. Symons cone crushers, the undersize being sent directly to the 54-in. belt conveyors which discharge the cone product on two 42-in. belt conveyors with trippers serving the coarse ore bin.

Treatment in the secondary crush-

Table I—Screen Analysis of Fine Grinding Circuit

Screen Analysis of One Section
(Using 7x10-in. Rod Mill)
Based on 1,853 Tons Feed per 24 Hours (2-7x10 Ball Mills)

	Rod Mill				Bowl Classifier			
	Feed 4.0% Moisture % Weight		Discharge 71.2% Solids % Weight		Sands 71.9% Solids % Weight		Overflow 25.1% Solids % Weight	
Mesh	Ind.	Cum.	Ind.	Cum.	Ind.	Cum.	Ind.	Cum.
On 4	0.2	0.2	....	....	....	....	....	....
6	2.6	2.8	....	....	....	....	....	....
8	10.4	13.2	....	....	....	....	....	....
10	12.4	25.6	0.3	0.3	0.6	0.6	....	....
14	11.0	36.6	2.9	3.2	2.9	3.5	....	....
20	8.6	45.2	5.8	9.0	10.7	14.2	....	....
28	8.4	53.6	11.9	20.9	21.7	35.9	....	....
35	6.6	60.2	12.5	33.4	22.8	58.7	0.4	0.4
48	4.8	65.0	9.3	42.7	17.6	76.3	2.8	3.2
65	4.0	69.0	8.7	51.4	9.0	85.3	6.4	9.6
100	3.8	72.8	6.7	58.1	6.4	91.7	8.0	17.6
150	4.0	76.8	6.1	64.2	2.6	94.3	9.2	26.8
200	3.2	80.0	6.1	70.3	1.1	95.4	11.2	38.0
Minus 200	20.0	....	29.7	....	4.6	....	62.0	....

	Ball Mill Discharge 73.8% Solids % Weight		Drag Classifier Sands 76.8% Solids % Weight		Drag Classifier Overflow 28.0% Solids % Weight		Combined Classifier Overflow 26.0% Solids % Weight	
Mesh	Ind.	Cum.	Ind.	Cum.	Ind.	Cum.	Ind.	Cum.
On 14	0.7	0.7	0.4	0.4	....	....	....	....
20	1.5	2.2	1.9	2.3	....	....	....	....
28	6.4	8.6	7.6	9.9	....	....	....	....
35	13.0	21.6	14.8	24.7	....	....	0.4	0.4
48	18.2	39.8	23.9	48.6	1.6	1.6	2.4	2.8
65	21.1	60.9	19.7	68.3	11.2	12.8	7.6	10.4
100	13.0	73.9	13.3	81.6	17.2	30.0	13.6	24.0
150	9.1	83.0	9.1	90.7	14.8	44.8	13.6	37.6
200	5.9	88.9	3.6	94.3	13.6	58.4	10.8	48.4
Minus 200	11.1	....	5.7	....	41.6	....	51.6	....

ing plant involves crushing in rolls and primary and secondary screening. The latter is in closed circuit with the rolls. There are four crushing sections in the plant. Section 1 employs in the primary screening department a 4x5-ft. Hum-mer screen, Section 2 two 4x5-ft. Hum-mer screens, and Section 3 a 4x7-ft. Hummer screen. The layout of a section is graphically explained in Fig. 1.

From the coarse-ore bin equipped with 25 apron feeders the material is passed by 34-in. belt conveyors to the primary Hum-mer screen in the respective section. These units are covered with screens containing 0.162x 4.125-in. openings, with the minus 6-mesh undersize going over 36-in. belt conveyors (two for four sections) to two 36-in. conveyors with trippers operating on top of the fine-ore storage plant composed of fourteen bins. The screen oversize is raised by means of a 38-in. bucket elevator to a surge bin, whence it is withdrawn through four roll-type feeders and passed over four Hum-mer screens with 0.125x 3.125-in. openings. Minus-6-mesh undersize from these secondary screens goes to the conveyors leading to the fine-ore bins, while the oversize, after crushing in 72x20-in. Garfield-type rolls, returns to the boot of the bucket elevator. As mentioned previously, the rolls and secondary screens are operated in closed circuit, the ratio of circulating load being about 5.2 to 1.

The two-stage grinding operations and subsequent flotation as carried out at the concentrator are illustrated by Fig. 2. For this work there are available in the fine-grinding department seven standard sections, each with a 7x10-ft. rod mill (open circuit) followed by a 15-ft. Dorr bowl classifier and two 7x10-ft. ball mills in closed circuit with two 8x26.7-ft. Dorr rake classifiers handling the bowl classifier sands, and, in addition, two sections similarly equipped except that the rod mill in each is 7x12 ft., thus making a total of nine mill sections in all.

In the flotation department there are ten rows of rougher flotation units, each row being composed of three 27x 6½x3-ft. Southwestern-type cells. The regrind section treating the combined rougher concentrate from the ten sections contains two 8x6-ft. Marcy ball mills operating in closed circuit with two 4½x31-ft. Akins classifiers. Combined concentrates sent to the regrind units assay about 13 per cent copper. Middlings from the second and third rougher cells return to the head of the first rougher cell. The 6 per cent plus-200-mesh material from the regrind units (ratio of circulating load 2½ to 1) is treated as follows: About two-thirds of the classifier overflow goes to two 18x6½x3½-ft. cleaners and one-third is sent to two 9x6½x3½-ft.

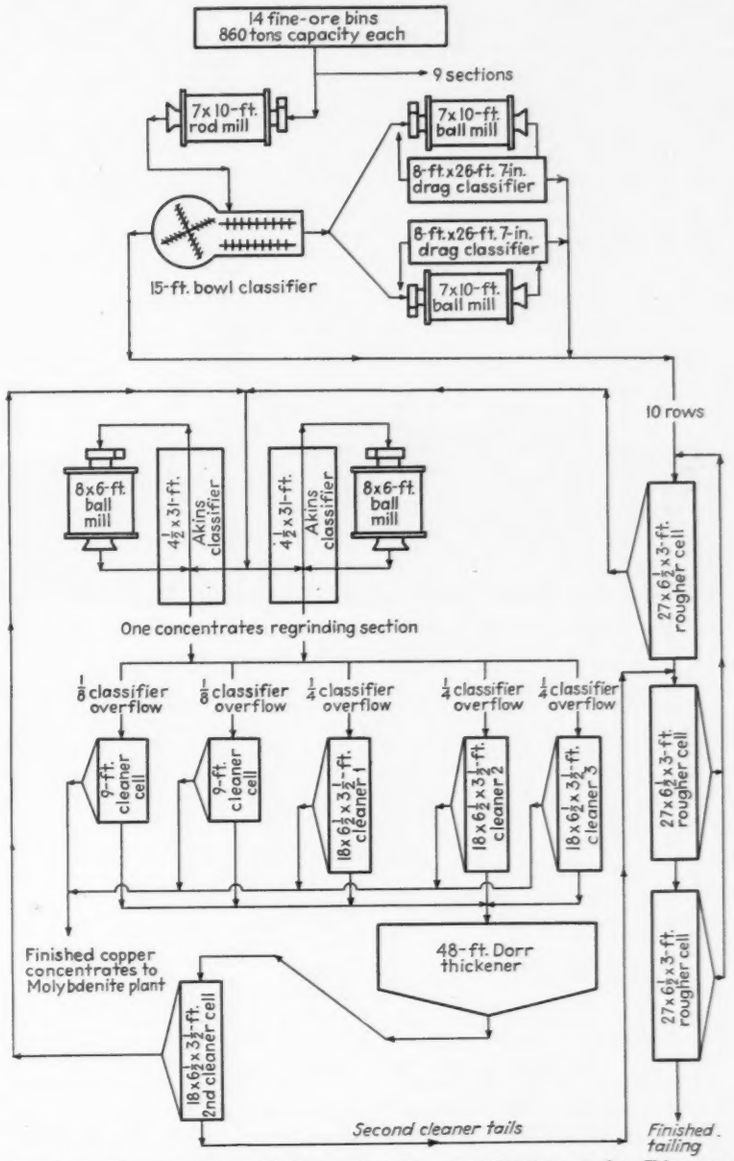


Fig. 2 . . . The two-stage grinding and subsequent flotation at the Chino concentrator proceed according to this flowsheet

cleaners. Tailings from the 18-ft. cleaners are directed to a 48-ft. Dorr thickener, and those from the 9-ft. units return to the head of the first rougher cell. The thickener underflow is re-treated in an 18-ft. cleaner machine, from which the concentrates are sent back to the regrind units.

Recovery of molybdenite is accomplished as explained in Fig. 3. Treatment involves thickening to from 50 to 60 per cent solids, removing reagents by heating the pulp in steam vats, cooling and reconditioning, and flotation. As will be seen, the copper concentrates, assaying about 30 per cent copper and 0.5 per cent molybdenite, are delivered to an 8x8-ft. surge tank, whence the overflow is directed to a 48-ft. Dorr thickener. Underflows from the thickener and surge tank, after addition of lime, are treated in six steam tanks operated in series, the necessary steam being supplied from the power house a short distance away. Each tank is equipped with a mechanical stirring mechanism, and the pulp treated therein is kept at a temperature just below boiling, about 205 deg. F. Cooling and dilution of the pulp to 15 per cent solids by addition of water is accomplished in the 8x7-ft. conditioner following the last two steam tanks. The conditioner product next goes to an eight-cell, 56-in. double-lip Fagergren flotation machine, the concentrates from the first five cells passing to the cleaner circuit, and the product of the last three cells returning to the thickener. Tailing, assaying about 30 per cent copper and 0.06 per cent molybdenite, is successively pumped to a 48-ft. Dorr thickener and Oliver filters before being loaded into railroad cars and transferred to the storage bins at the adjacent smelter. In the cleaner circuit employing four 44-in. double-lip

Chino Copper's new smelter, blown in at Hurley, New Mexico, on May 2, 1939. It has a 32x126-ft. reverberatory and two converters

Fagergren cells the molybdenite content of the concentrates is raised above 85 per cent and the copper content lowered below 1 per cent. Concentrates taken off the last cleaner cell are dewatered in a two-leaf, 4-ft. diameter disk filter, with the cake subsequently passing to a steam-jacketed screw conveyor discharging into a steel storage bin.

The Smelter

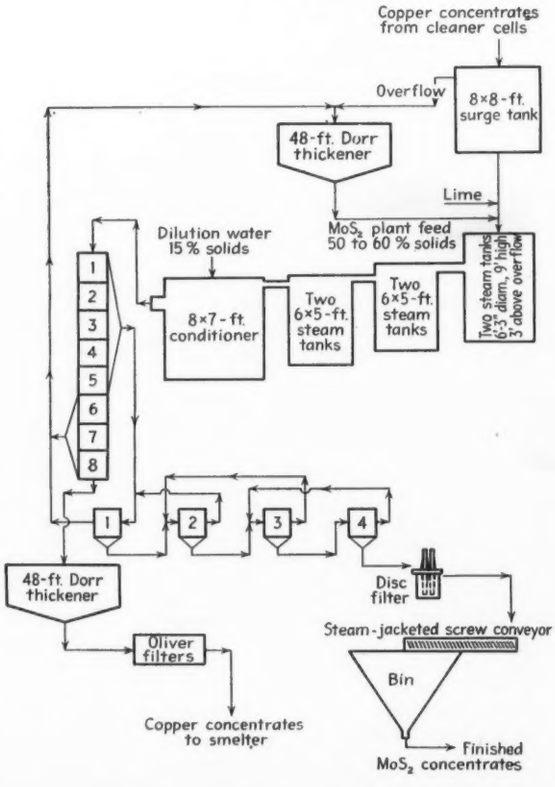
Authorization for the construction of the smelter was given in April, 1937, and the completed plant was blown in on May 2, 1939. The visitor here sees an example of the most modern design coupled with an adequate and intelligent expenditure of money. Built for permanence, economical upkeep, and low operating costs, the operators have a plant to be proud of. Spacious interiors and extra high ceilings in the different buildings provide healthful and safe working conditions for the men, and with most materials being handled and distributed mechanically by means of conveyors the major part of the rolling stock found at the average smelter has been eliminated. Several operations, as for instance the Cottrell plant, are entirely automatic. The reverberatory furnace is of the wet-charge type, the charge being distributed along the furnace by two vibrating conveyors. Although insufficient time has elapsed since the blowing in of the smelter to permit collection of operating data, a brief description as to layout and equipment used may be of interest.

The smelter is a short distance north of the concentrator. There are three separate units, all linked together by belt conveyors—namely, a flux-crushing unit, storage bins, and the smelting plant proper, with its dust recovery system and 501-ft. concrete stack. At the flux-crushing plant, the material received from the mine in 75-ton steel cars is dumped into a hopper-bottomed steel bin, from which it is fed by a pan feeder over a double-deck vibrating screen covered with screens containing 3x3-in. and 1¼x2-in. openings. Screen oversize is reduced in a 7-ft. Symons cone crusher fitted with a fine product bowl. The finished product then goes via a 24-in. incline belt conveyor to the storage plant. Here are available fourteen concrete bins (23½x24 ft. inside, walls 1½ ft. thick), of which twelve are used for concentrate storage and two for flux and lime rock. Material withdrawn from the bottom of each bin is transferred to respective points in the smelting plant by a series of conveyors. Essentially, the smelting equipment consists of a 32 x 126-ft. reverberatory furnace and two 13x30-ft. Peirce-Smith converters. Ample space is provided in the building not only for this equipment but for an additional reverberatory furnace and converter. The crucible of the reverberatory furnace is lined with magnesite brick; the sides and roof (save for two sections of firebrick on outlet of furnace) are of silica brick construction. Concentrates are charged by means of two vibrating conveyors above the side walls of the furnace, which are periodically fed from two elevated steel bins. There is also a bin for flux or lime rock.

Slag and copper matte are tapped from the side of the furnace, which is fired by natural gas through multiple jet burners. Tapped slag is directed into ladle cars in the slag tunnel on the flue end of the furnace, which are hauled to the dump by electric locomotives, and the copper matte goes to the converters in ladles lifted by a crane with one 45-ton hoist and two 20-ton auxiliaries. At the burner end of the furnace two slag launders are available. Waste-heat equipment consists of two Stirling-type boilers with a heating surface of 12,600 sq.ft. each and designed for 525-lb. pressure and 750-deg. superheat.

The two basic-lined converters contain 52 tuyeres. Flux is stored in three elevated bins, from which short belt conveyors direct it to the measuring hopper at the side of each converter. Blister copper from the con-

Fig. 3 . . . Molybdenite occurring in the Chino ore is recovered as shown here



verters goes to a 10x17-ft. gas-fired holding furnace and then to the molds of a straight-line casting machine. From the water pit below the casting machine a steel conveyor elevates the cooled cakes to the loading floor, where they are stored before being loaded into railroad box cars for shipment to the refinery.

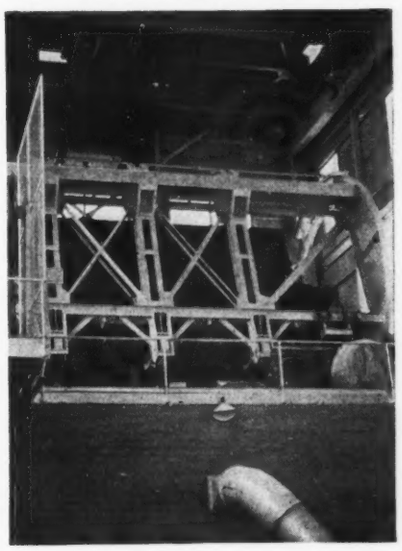
Alongside the reverberatory furnace there are four elevated steel bins for storing clay and other materials necessary for furnace and converter repairs. Clay stored in two bins is withdrawn on a short belt feeder and treated in a small mill below whenever needed. Converter gases pass through a 12-ft. balloon flue to the 16-ft. balloon flue just behind the reverberatory furnace leading to the Cottrell plant and stack. The Cottrell plant, which can be bypassed whenever this is desired, contains four treatment units (additional space has been made available for a fifth unit), and operation of the plant is entirely automatic.

Accumulated flue dust and waste-heat boiler dust are returned to the concentrate storage bins above the reverberatory furnace via respective conveyors discharging on the main belt conveyor running between the bedding plant and the furnace feed storage bins.

The new plant's 501-ft. concrete stack has a diameter at the base of 42 ft. 8 in., and at the top 20 ft. Its interior is lined with acid-proof brick, with a layer of rock wool between the concrete and the lining proper. The top 40 ft. of the stack is of acid-proof brick.

Power and air needed at the smelter are furnished by the mill power house, which utilizes the steam produced by the waste-heat boilers as well as that generated by the conventional boilers.

Rotary car dumper at the new primary crushing plant



Some Flotation Results at Alaska Juneau

Use of suitable reagent to cause intermittent frothing, with alternating periods of accumulation and discharge, gives monthly average concentration ratio of 1,600 *to* 1 *on slimes. Method also applied to middling circuit*

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EARLY DEVELOPMENT and application of flotation to Alaska Juneau metallurgy were described by R. G. Hall, in his article "The Importance of Flotation at Alaska Juneau," which was published by *Engineering and Mining Journal* in January, 1938. At that time, experimental work on the treatment of the slime fraction of the ore had proceeded to a point where a cone and thickener had been installed in one section of the mill, and two large air cells for the treatment of the slime underflow of the thickener were also installed.

The foregoing pilot work was in some respects encouraging, but not entirely conclusive. Though slime flotation heads averaged 50c. and tailings 17c., the concentrates averaged only $80, with a small lead content. In some localities, a concentrate of $80 is considered satisfactory, but in Alaska Juneau operations, the freight and treatment costs on concentrate are about $40 per ton. Lead and silver values being negligible in the $80 concentrate, a high percentage of the gold recovered was required to pay these costs. A higher percentage of lead was also important, in that it would help pay the freight and treatment charges and make a concentrate that would not heat in shipment. That a major problem would be in producing a higher grade of concentrate was clearly indicated from the start.

Approximately 180 tons was being treated daily in the pilot plant; results, due to considerable courage on the part of the management, were judged as sufficiently encouraging to justify an installation of greater capacity.

The air cells used in the pilot work had been developed to treat a large volume of low-density pulp. It had been found that the cone overflow taken direct to flotation without thickening fluctuated so greatly in volume and density as to be unsuitable as a source of flotation feed. Installation of a thickener to thicken the cone overflow served several important purposes, most important of which was the large reduction in the volume of pulp to be treated, making possible the use of large-size commercially manufactured flotation equipment, serving also to produce a pulp of uniform volume and density.

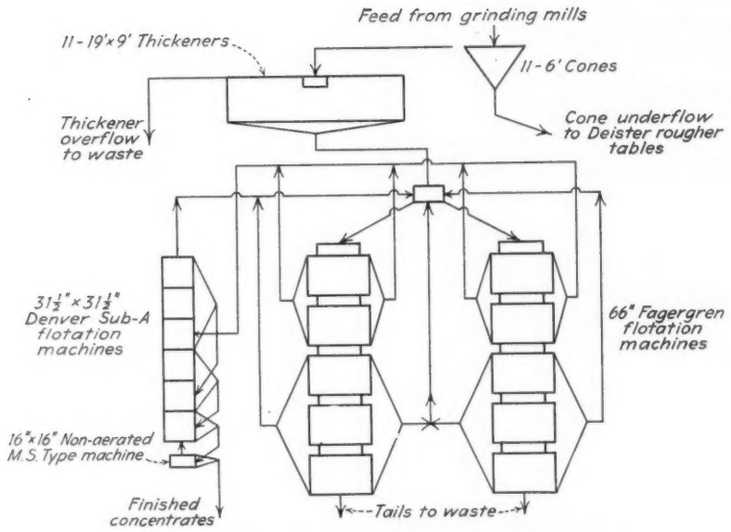
For the new slime plant, the rougher requirements were high speed, intensity of agitation and aeration, large volumetric capacity, and mechanical ability to handle large volumes of pulp. Five 66-in. square-type Fagergren machines were selected for this purpose. For the cleaning circuit, a Denver (Fahrenwald) 31½x31½ in. of six cells was installed. Requirements for the cleaner were moderate agitation, and flexibility for circuit arrangement.

The rougher arrangement was as follows: The first two cells produce a rougher concentrate, which is pumped to the first cleaning stage. Froth produced by the last three rougher cells is circulated to the head of the rougher.

The cleaner was arranged in three stages with cells 4, 5, and 6 making stage No. 1, cells 2 and 3 stage No. 2, and cell No. 1 the final stage of cleaning. Cleaner tailings flow in reverse direction to the head of the rougher.

By the time the equipment was placed in operation, the slime values had dropped to an average of 42c. and contained 0.04 to 0.07 per cent Pb. Tailings of $0.17 were consistently made. Concentrates averaged $100 per ton.

After considerable experimenting with reagent combinations, various manipulations, and the installation of



Flowsheet of Alaska Juneau's 2,000-ton slime flotation plant

a small M. S. type non-aërated cell for a fourth cleaning stage, the grade of concentrate had been raised to an average of $115 Au, 15 per cent Pb, and 14 oz. Ag. At this stage, a discovery was made in the course of our work, and a process developed that largely accounts for the improved grade of concentrate and the general success of flotation at Alaska Juneau.

Soluble starch was in use as a carbon depressant, being fed to the head of the rougher and to stages No. 1 and No. 4 of the cleaning circuit. It was observed that after the addition of more than the usual critical amount of starch to the last cleaning stage, the froth was broken down, and for a time no concentrate was produced. After a period of non-production, it was observed that the first concentrate to be produced was very high in grade, the grade gradually dropping with a resumption of normal cell operation. After some study, we decided to attempt to control and regulate the production of concentrate into timed periods—(1) accumulation in the circuit when no concentrate would be produced; (2) periods when the accumulated and enriched concentrate would be discharged.

A starch feeder and rubber hose to feed starch to the feed launder of the final cleaner cell were installed, and starch in excess fed to the machine for a period of 10 min. The result was the breaking down of the froth, with no production of concentrate for this period and for the ensuing 10 min. while the froth was building up after the feeding of starch had ceased. Concentrate was then allowed to discharge for about 10 min. The periods for accumulation and discharge are varied to meet conditions. We have operated with periods of as long as 45 min. for accumulation of values and periods of 5 to 20 min. for discharge of enriched concentrate. The effect of the reagent is sharpest on the cell to which it is added and rapidly wears off as it progresses down the line of cleaner cells. While froth formation is checked on the last cleaner cell, the other cells continue to froth and circulate concentrate.

The application of starch or other reagent suitable for the purpose is primarily to modify the surface tension of water, preventing or checking the formation of froth in the last stage of cleaning. It is obvious that when froth formation is again permitted in a pulp well loaded with values, the concentrate will be very rich for a time, the grade dropping as the concentration of gold and lead is reduced in the circulating pulp. By this method, a degree of selectivity is developed and kept under control that had been impossible to approach by any known standard methods of selective flotation. Differentiation between minerals is highly developed and the selection of one or more minerals is possible according to their rate of floatability.

Application of the method may be manual, or may be made fully automatic by the use of a time switch in the motor circuit of the reagent feeder. The variables are the amount of reagent fed and the length of the cycles of accumulation and discharge. Application of the depressing reagent may be regulated to give merely a checking effect and range to rather prolonged periods of non-production of concentrate. The use of starch has been mentioned here, but other reagents will be suitable in the application of the method to other problems.

The result of this treatment was a material and immediate increase in the grade of concentrate. As skill and experience were gained by the operators, the grade of concentrate produced from 40c. heads has improved, until now an average gold value of $350 to $400, with 50 to 60 per cent lead, is obtained.

Ratio of concentration has increased from 380 into 1 to a point where some 24-hour runs reach a ratio of 3,000 into 1. The monthly averages are about 1,600 into 1. Rejection of the iron sulphides, pyrites, and pyrrhotite is virtually complete. Because of the pyrrhotite content, flotation concentrates formerly produced had a strong tendency to burn in transit.

After the successful application of the intermittent method of producing concentrate to the slime circuit, the method was successfully applied to the middling circuit, where $200 to $350 concentrate was being produced from heads of $1.35. Concentrate grades were improved to an average of between $800 and $1,000, some shifts producing concentrates of over $2,000 per ton.

It is important to note that there has been no indication of increased tailings loss due to the application of this method.

A second installation of five Fagergren cells duplicating the first has been made, and slimes amounting to approximately 2,000 tons per day are treated in the two rougher circuits. In addition, 350 tons per day of reground middlings are also treated in these machines, with treatment time of slightly over 3 min.

Tailings from the slime flotation circuits have been quite consistent at 17c. Investigation has shown that the tailings contained enough sulphides to give them an iron content of 5.5 to 6 per cent. This iron carries a small but definite amount of locked gold, which is sufficient to account for 13c. to 14c. of the tailings value, leaving but 3c. to 4c. unaccounted for.

During part of the winter months, milling is done in varying concentrations of sea water added to the available fresh mill-water supply.

Amyl xanthate is the collector used when milling in fresh water. Our practice has been to use minimum quantities of collectors to avoid overactivating iron sulphides. With salt-water conditions, xanthate consumption is increased 300 per cent and in addition Minerec B and Aerofloat No. 242 are required.

Alaska Juneau ores are difficult to froth, and it was only after the introduction and development of special frothers that the reagent costs were brought down to about 1½c. per ton. Our special frother is used with pine oil or cresylic acid, and acts as an accelerator for the standard frothing agent. Used in proper proportions, a small bubble froth of excellent texture is produced. Though the froth is somewhat more voluminous than when using standard frothers, it is not a tough, persistent froth. Selectivity is excellent, and experience has shown that somewhat smaller quantities of collectors are required than in the use of standard frothers.

A Plan for Protecting Direct Investments of Foreigners in Latin America

It provides mutual advantages through cooperative endeavors for both the foreigners concerned and the nationals of the countries where the enterprises are established

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DURING the Eighth International Conference of American States which convened in Lima, Peru, during December 1938, the draft of a convention by which the States of the Americas would recognize the validity of renunciation of diplomatic protection by their nationals was presented for consideration. The proposed convention urged for adoption as a principle in international law in the Americas the thesis that, in case of confiscation or expropriation of property, foreign companies or foreign citizens are to have no recourse that is not also available to nationals of the country that has confiscated or expropriated the property. The purpose of the proposed convention was, seemingly, to obtain the formal recognition by the United States of the abrogation of its inalienable right to diplomatic action for the protection of property of its nationals and corporations. The proposed convention had the support of some of the strongest Latin American countries, but was not adopted by the Lima Conference. However, it was referred to the Commission of Experts on the Codification of International Law for further study and for report at the next International Conference of American States, when it will again come up for discussion. In view of this fact and of the propaganda which meanwhile will be persistently advanced by the Latin American nations favoring such a proposal, it behooves all who are interested in the protection of United States investments in Latin America to give careful consideration to the probable effects resulting from the adoption of the proposal as well as to adopt ways and means of strengthening the increasingly precarious position of all foreign investments in certain Latin American states. Neglect to take action to reverse this trend offers any non-American State ample excuse to challenge our right as well as our ability further to maintain the principles of the Monroe Doctrine, never more necessary than at present for the defence of all America against intrusion.

In theory, the principle contained in the proposed convention might be rendered partially satisfactory in so far as expropriations are concerned —if hedged about by strict regulations as to immediate reimbursement in free currency, property valuation, protection of foreign bond and stock interests, arbitration of disputed points, etc. Even then, the proposal leaves out of consideration an important recourse of the national, not available to the foreigner—i.e., the vote. The national supposedly supports or disapproves his government's action at the polls; the foreigner, however great his interest, has no such safeguard, nor is it desirable that he should have. But, in all fairness, his position must not be rendered less secure than that of the national. Viewed thus, the foreign investor has no advantage over the national, by the exercise of his right to diplomatic intervention. In fact, the national still has the advantage over the foreigner, since with the national alone rests the power to remove the government from office, or even to demand and obtain by legal vote the complete reversal of confiscatory action.

Expropriation is a recognized right of governments, and upon occasion, in defense of public interest, it is necessary. Nor does it affect adversely the diplomatic relations or the international credit of the expropriating nation, provided such action is judiciously and infrequently taken and executed with strict regard for prompt and adequate settlement of the property rights of the expropriated investors. But expropriation used as a government policy of discipline or to accomplish state ownership overnight assumes a confiscatory character and is as destructive of national credit and stability as is default, unilateral action taken with regard to service on bonds as distinct from the terms of contract, or revolution. Nor does it bring to the government employing it the domestic riches so brightly envisioned and easily promised to the nation. However good the intentions of a government to reimburse investors when and as it can, expropriating tendencies ruin credit, stability, trade, and pleasant diplomatic relations. These are reasons strong enough in themselves to eliminate consideration of expropriation as a policy for any nation desirous of advancing rapidly to a secure and powerful economic position.

What has occasioned resort to expropriation in some of our sister republics? The very natural desire to acquire, each nation for itself, ownership of its national resources and enterprises and along with this, the sole power to decide the rate at which these will be developed. For such undertakings, adequate capital, skilled labor, and administrative and technical skill as well as initiative and experience are lacking in many countries in South and Central America. The United States faced the same problem in the early history of their expansion and solved it in time by the use of foreign capital, skill, and technical assistance. They were not too proud to learn from their industrial superiors, while developing their resources with foreign capital. Eventually, home industry, initiative, and frugality made it possible for United States nationals to acquire some of the stocks and bonds of enterprises developed by foreign capital. Thus, gradually the North Americans became the owners of their national enterprises. The story will be no different for Latin American republics if they bend their energies to accomplish the goal in the same way. This can be attained, not by arbitrary, discriminatory, or confiscatory legislation and unsub-

stantiated accusations, but by co-operation on the part of the governments and active intelligent interest on the part of the nationals.

Yet such has not been the tendency of thought in Latin America in recent years, and the past quarter of a century has seen marked changes there in the attitude toward foreign capital and its place in the development of industrial life. The old-time recognition of national limitations which welcomed the assistance of foreign capital and technical aid has yielded to a grudging hostility and resentment which have manifested themselves in continued charges of exploitation, climaxing in some recently enacted laws which practically confiscate the present foreign investor's property. Other laws have been decreed which completely eliminate the prospective foreign investor from the development of subsoil resources.

This attitude of mind persists among some Latin Americans in spite of the easily verified fact that, no matter what the wish of the foreign investor may be, with but few exceptions from 50 to over 90 per cent of every dollar's worth of production remains permanently in the country in the form of money spent *in* the country for wages, food supplies, materials, equipment, local improvements, royalties, taxes, etc., and that sums so expended are as unrecoverable by the investor as they are of permanent benefit to the country in which they are spent.

Another widely proclaimed grievance of Latins against foreign development of national resources is that the foreigner takes all and leaves nothing, since operations are conducted by corporations whose entire common stock is held abroad. That stock ownership is largely held abroad is true, but that is not due to exclusionary measures on the part of the foreign companies. Latin Americans are free to buy stocks in parent companies owning the foreign operating company. That they do not do so is largely due to exchange restrictions, unfamiliarity with dealings on foreign stock exchanges, and an inherent unwillingness to invest in a holding company with world-wide interests. The Latin quite naturally wishes to own a part of a successful enterprise operating in his own country. It is just here that I suggest that a plan might be evolved that would work to the advantage of Latin American countries in securing to them the final acquisition of the properties developed for them by foreign capital and management. Such a plan would make the nationals and foreign investors participants in the ventures undertaken, not antagonists, and would go a long way toward removing the one great provocation to serious differences that have arisen between the United States and our sister republics.

United States citizens and corporations have over three billion dollars in long-term investments in Latin America. Of this total, approximately two-thirds represents direct investments in enterprises, and it is with the protection of these direct investments that this article is concerned. (The article is not concerned with foreign dollar bonds and miscellaneous securities of Latin American countries held by United States citizens, as the formula proposed herein is not applicable to the protection of such investments.) The protection of this huge sum as well as the safeguarding of any future investments that may be made by United States corporations or individuals in Latin America presents a problem of first magnitude. But this

problem is not our only deep concern. Such protection for *all* foreign interests must be afforded as will insure Latin America and ourselves against any excuse on the part of non-American nations to flout the principles of the Monroe Doctrine, in defence of their nationals' interests.

In short: the United States must protect its present investment in Latin America and would like to assure itself of secure and profitable future outlets for its surplus capital. It must maintain the principles of the Monroe Doctrine for the protection of all America. Latin America aspires to ownership and control of its natural resources and enterprises. At present it has neither the capital nor the experience requisite to do this. It cannot resort to arbitrary and confiscatory methods without grave financial losses and peril to its credit and economic stability. Moreover, such action might bring the Americas into serious dispute with non-American nations asserting the property rights of their citizens. To help solve the problem for both the United States and for Latin America some plan of action has been seriously and earnestly sought, and the following outline of a general formula is submitted as offering promise of at least a partial solution.

The general formula has recently been worked out for application to a small public utility owned by a company incorporated in the State of Delaware and operating as a United States stock company in Latin America. It has 250X in common stock and net assets of 300X. Under the proposed plan, this company will reincorporate in the country in which it operates, and its assets will be taken over by a national (Latin) company with the following structure:

Bonds, U. S. currency, 5%; 25 year	100X
Preferred stock, U. S. currency, 7%	100X
Common stock, U. S. currency, no par	100X
	300X

which the present United States stockholders will receive.

The statutes of the reorganized company will carry the stipulation that the management of the company remain in the hands of the bondholders until the bonds are amortized by the 25-year sinking fund or by a previous complete liquidation of the bonds by owners of control of the common stock. The way is thus opened for Latins to acquire actual operating control of properties financed by foreigners—i.e., by paying off the bonded indebtedness and acquiring majority control of the common stock.

The preferred stock will be sold by United States stockholders to citizens of the country in which the utility operates, one share of common stock being given with every two shares of the preferred sold. If all of the preferred stock is sold, the new ownership of the reincorporated company will be as hereunder:

The United States investor will own 100X in 5% 25-year bonds and 50X in no-par common stock.

The Latin investor will own 100X in 7% preferred stock and 50X in no-par common stock.

If this plan is consummated, the United States investor will have 40 per cent of his actual investment returned to him in cash through the sale of the preferred stock; will have 40 per cent of his actual investment returned to him in the form of secured bonds; and will have (representing the remaining 20 per cent of his actual investment), 50 per cent of the common stock.

Though the plan detailed in the foregoing has been worked out for application to a going concern operating in Latin America (and has been adopted in a general stockholders'

meeting), the general formula may be applied to any foreign-owned property operating at a substantial profit in Latin America provided the ratio between the bonds, preferred, and common stocks be properly determined in each individual case.

To receive the full advantage of the application of the formula to foreign-owned enterprises operating in Latin America under exchange restrictions and control, the problem of transfer of exchange requires a solution. It is suggested that frozen funds in such countries might be available for the development of additional exports, thereby creating more exchange. As an inducement to proceed with the development of new industries even under current exchange restrictions and control, companies undertaking such new developments and creating additional exchange should be allowed to retain 50 per cent of the foreign exchange created by the export of the companies' products, the remaining 50 per cent of the exchange created to be sold to the exchange control authority at the free rate. Such a procedure would develop new industries, liquidate frozen funds, and permit the eventual return to the investor of such funds as had been obtained in the application of the formula proposed. Meanwhile, the enterprises taking advantage of the application of the formula would have the protection for their investments summarized hereunder.

Another suggestion for the solution of the problem of the transfer of funds is an arrangement with exchange control authorities in each country in which the formula is applied to specific enterprises, to permit the return of the funds resulting therefrom over a period of time, the period to be agreed upon in each particular transaction. Exchange control authorities should be convinced of the soundness of such a procedure, inasmuch as the nationals are thereby afforded an opportunity to obtain an interest in profitable going concerns under the exceptionally favorable conditions outlined in the general formula.

To summarize: The adoption of the plan outlined in the foregoing or of a similar one would help to accomplish the following results:

From the point of view of the foreign investor:

1. Eliminate confiscatory expropriation of property owned by foreign citizens and corporations in Latin America, and afford some protection against adverse legislation.

2. Assure the return of a proportion of the capital invested; guarantee another proportion by secured bonds, and give the foreign investor a "run for his money" on the balance.

3. Permit the United States to maintain its position in Latin America and thereby help to withstand the determined efforts of Germany, Italy, and Japan to advance their interests in the Americas.

4. Obtain sympathetic consideration from the Latin American public and its law courts, as each would be dealing with enterprises in which their own nationals would be heavily interested.

5. Discount, if not end, the hostile claims (in so far as applied to corporations adopting the proposed plan) that the resources of Latin America are being exploited only by foreigners.

From the point of view of the Latin Americans:

6. Indicate a desire on the part of foreign corporations to share with Latin Americans in the benefits originating from the investment of foreign capital and the development of successful enterprises by the foreigners' technical skill, hard work, business acumen, and initiative.

7. Assure Latin Americans that they may eventually acquire control of the successfully initiated development of their resources by paying off the bonded indebtedness on installations that have been financed and operated by foreigners.

8. Create a feeling of security on the part of Latin Americans which the actual ownership of common stock equities in enterprises operating their concessions and developing their resources would inevitably engender.

9. Convince the Latin Americans that United States citizens and corporations are seeking a cooperative development of the concessions and resources of the Latin Americas—United States nationals and corporations furnishing funds, technical skill, and initiative to develop the concessions and resources which the Latin Americas have, and manifesting a willingness to share profits on a reasonable, equitable basis.

▼ ▼ ▼

Tin in Coosa County, Alabama

Further prospecting yields interesting results

TIN was reported from Alabama as early as 1880, but no importance was attached to the scattered records of cassiterite crystals and no extensive exploratory work was attempted until 1934. That summer E. W. Ellsworth, working on Public Works Administration funds for the U. S. Geological Survey, spent four months investigating the known tin deposits of the State. Few deposits were known at the time, and on the basis of analyses of carefully made samples from these, Ellsworth decided that they did not contain sufficient cassiterite to warrant commercial exploitation.

Since the appearance of Ellsworth's report (Ellsworth, E. W.: "Tin Deposits of Alabama," Department of the Interior, Press Memorandum No. 20674, Oct. 24, 1934, abstracted in *E. & M. J.*, December, 1934, p. 562), however, extensive prospecting has been done in Coosa County along the strike of the stanniferous pegmatites, and new occurrences of tin have been found, according to a recent preliminary report made by Edgar Bowles, of the Geological Survey of Alabama, University, Ala. The report states that these newly located deposits cover a range of 10 to 12 miles along the strike. The cassiterite occurs in stanniferous pegmatites intrusive into the Wedowee formation and the Pinckneyville granite of the crystalline Piedmont belt. A detailed description of the general geology and geologic relations of these stanniferous pegmatites appears in Ellsworth's report. The pegmatites all strike approximately 20 deg. northeast and the dip varies from 50 to 80 deg. southwest.

The deposits were visited by Mr. Bowles in July, 1939, but time did not permit a detailed examination of all the deposits. Samples were taken from various outcrops, but they were "grab" samples and not accurately nor systematically taken. An attempt was made to obtain representative samples, but careful sampling using customary methods would probably give results somewhat at variance with those recorded here.

Though this report is in no sense final nor definite, the unusual and possibly commercial occurrence of stanniferous pegmatite in eastern Alabama has aroused so much interest that it is thought a preliminary series of analyses might be of value. The percentages of metallic tin in the ores seem sufficiently high to warrant further and more detailed exploration of the pegmatites. Test pits and trenches should be dug on the outcrops and representative samples should be taken. Such prospecting on an extensive scale seems completely justified by these preliminary studies.

Results of ten samples analyzed by J. Milton Jernigan, of the staff of the Geological Survey of Alabama, may be summarized as follows: Locality 1, 2.80 per cent tin (Sn); locality 2, 0.25; locality 3, 0.83; locality 4, 0.29; locality 5, 3.30; locality 6, trace; locality 7, trace; locality 8, 1.30; locality 9, 0.76; locality 10, 0.14.

The plant of the Baguio Gold Mining Company and the immediate vicinity. 1, The mill. 2, Staff houses. 3, Portal of Hoover tunnel. 4. The road to Baguio

Mechanics of Vein Formation

In the Northern Half of the Baguio District

Clifton W. Livingston
Chief Engineer and Geologist
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▶ MR. LIVINGSTON SETS FORTH his *analysis of the ground movements in the north half of the Baguio district, on the island of Luzon, in the Philippines, as arrived at by detailed mapping of the geology of the Baguio Gold Mining Company. The purpose of this work was primarily to direct exploration of unknown areas within the limits of company property. However, the article should be of general interest to other operators in the district as well as to students of the mechanics of vein formation. A portion of the article is devoted to a discussion of theoretical shearing.*

THE PROPERTY of the Baguio Gold Mining Company, consisting of 61 full and fractional claims, lies 9 km. east of the city of Baguio, the summer capital of the Philippines. Air, rail, and automobile transportation connects the city with Manila, 160 miles to the south. The property lies near the north end of the mineral district at the headwaters of the Antamok River, at an elevation varying from 3,600 to 4,500 ft. The district is 11 miles long by 5 miles wide and includes such well-known producers as Benguet Consolidated, Balatoc, Antamok Goldfields, Itogon, and Demonstration. Topography is precipitous; vegetation is subtropical; and erosion is speeded up by a combination of heavy rainfall, decomposition from organic acids, and steep stream gradients.

The ore deposit, like others of the district, is of the epithermal type. The gold is very fine and occurs in the native state in a quartz and calcite gangue in veins 3 to 15 ft. wide. Traces of tellurides are known to exist in certain parts of the district, but their presence has not been detected at this property. Traces of galena, chalcopyrite, and sphalerite are associated with the quartz mineralization. Some marcasite and an abundance of pyrite occur as primary constituents of the intrusive as well as being associated with the later surges of the mineralizing solutions. Their presence at Baguio Gold usually indicates an impoverishment of values. The presence of rhodochrosite indicates better than average values. Much of the manganese present has been, and is being, transported and deposited as a colloid. Secondary enrichment of the ore deposit is not to be expected with the calcite gangue and the basic nature of the ground water near the veins. Gypsum and anhydrite are particularly abundant at Baguio Gold as well as elsewhere in the district. Their origin and relation to the ore deposits are matters of speculation by operators and geologists. My own opinion is presented in the paragraph on mineralization.

Inasmuch as the geology and fracture pattern of a district are interdependent upon the geologic history, their correct interpretation necessarily collaborates the latter. Features of the geologic history recorded in the rocks at Baguio Gold completely agree with the work of Dr. Warren D. Smith[1] written in 1924, a brief abstract of which follows:

1. The Mesozoic is at present repre-

[1] "Geology and Mineral Resources of the Philippine Islands." Pp. 85–87, 111–114.

sented in the Philippines by slates interbedded with manganese oxides, schists, and radiolarian cherts into which granodiorite, diorite, and granite were intruded late in the period. During the Cretaceous, intense dynamism with both subsidence and uplift metamorphosed the early Mesozoic sediments into slates and schists. The Philippine Archipelago was a great land mass above the sea, which remained as such during the Eocene.

2. A general subsidence during the Miocene is represented by coal deposits and shallow water formations deposited unconformably upon the older formations. Emergence, beginning in the middle of the period and continuing until the close, was accompanied by folding and faulting of the earlier sandstones, shales, and coal beds. Intrusions and extrusions of andesitic and basaltic lavas were followed by the second period of ore deposition in the Archipelago. (Includes the Baguio district.)

3. Another period of erosion and subsidence during the Pliocene resulted in the deposition of coarse sediments and coraline limestones unconformably upon the Vigo and Batan Series of the Miocene while the waters were still shallow. The coraline limestone member is well exposed at Mount Santo Tomas, near Baguio. Sandstones and limestones were deposited as the subsidence continued.

4. A period of uplift proceeding into the Pleistocene followed, leaving the Archipelago at its present elevation.

5. Volcanic activity of the explosive type is responsible for the presence of cones of fragmental ejecta and extensive tuff deposits laid down during the Recent period. The islands are again passing through a period of erosion and subsidence.

The Local Geology—Fig. 1 is a horizontal projection at an elevation of 3,900 ft. showing rock types as well as the positions of known veins at Baguio Gold. The oldest rocks are the sediments, which are believed to correspond to Smith's early Miocene Vigo Series. The series consists of interbedded shales, sandstones, and conglomerates. Contacts between the members are all gradational. The source rock is chiefly andesitic. Fragments of quartz, granite, and red chert—which is believed to be Jurassic—have been observed. Folding has taken place along axes having their directions roughly northeast. Metamorphism of the sediments along the andesite contact has been intense.

The first andesite intrusion was probably contemporaneous with emergence, folding, and faulting of the middle Miocene. Early workers in the district have often classified these andesites as flows. The absence of flow structure, and the abundance of evidence supporting their intrusive nature, are considered by me, and substantiated by other recent workers, as conclusive. The early andesites vary from green through various shades of gray to black in color. Their fine grain texture and brittle nature cause them to shatter readily under stress. Joint systems and sheeting formed in them are in most cases sympathetic with the vein systems in the immediate area. Local segregations of hornblende appear scattered throughout the intrusive mass, heaviest concentrations occurring near the contacts with other rock types. Only small amounts of hypersthene are present.

The intrusion of diorite into the andesite followed. Near the contact the andesite is locally metamorphosed, black in color, and exhibits a conchoidal fracture. Edges of the diorite present a chilled appearance. The thickness of the chilled edge is variable, but reaches a maximum of 100 ft. in certain locations. The diorite at the plane of the horizontal projection varies in width from 400 to 1,000 ft. Its flanks dip away from the center at approximately 45 deg. The 2 Vein fault displaces the east flank of the diorite at the plane of the vertical section, Fig. 2, resulting in a fault contact for a short distance. So as not to confuse this diorite in age with that occurring in the southern part of the district, the name Baguio Gold diorite is proposed. It is a dense, compact rock of uniform medium to coarse grain texture. Small amounts of primary pyrite are present, and pyrite is the only accessory mineral observed megascopically with the rock-forming hornblende and plagioclase feldspar. Joint systems within the diorite reflect all stages of the dynamic activity. Fractures in it die out rapidly with depth. Its ability to resist stress has been of utmost importance in molding the fracture

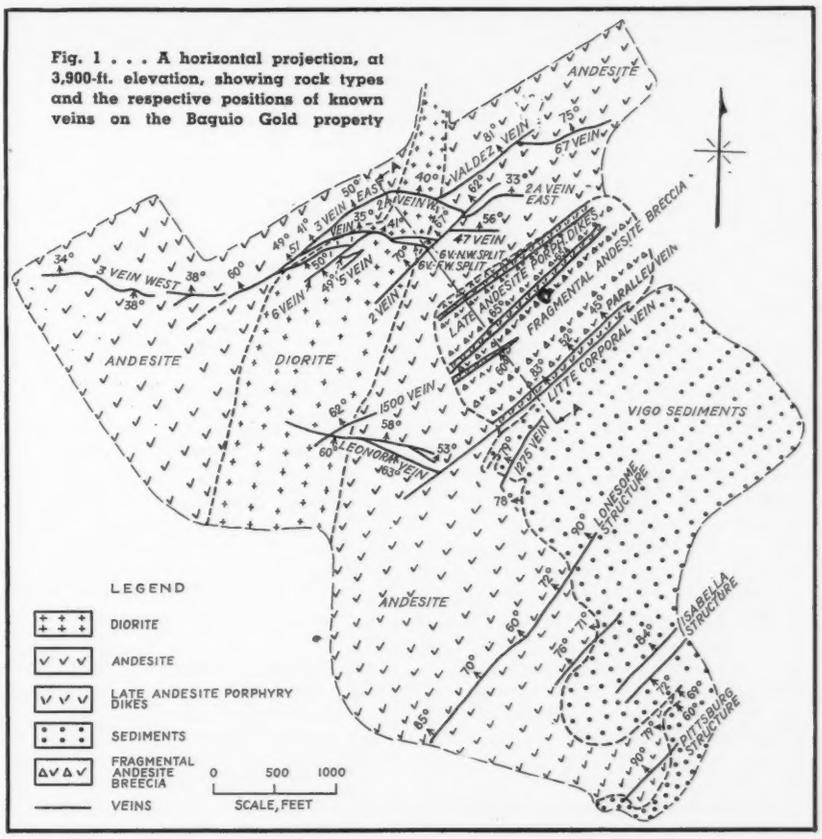

Fig. 1 . . . A horizontal projection, at 3,900-ft. elevation, showing rock types and the respective positions of known veins on the Baguio Gold property

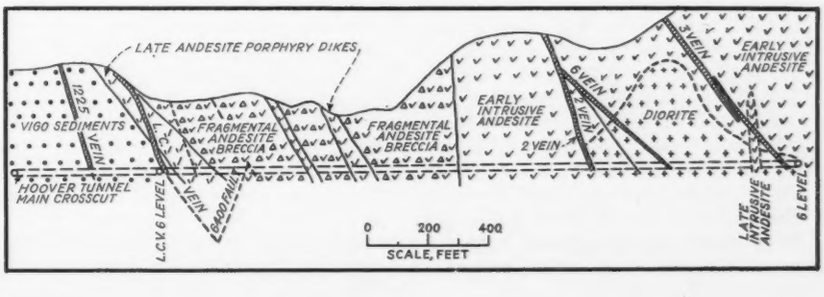

Fig. 2 . . . Vertical section on line A-A in Fig. 1

pattern of the Baguio Gold region.

Smith's Mesozoic diorite may be present outside the limits of Baguio Gold property; however, there are no known occurrences within the area to which mapping has been confined.

Late andesite dikes followed the course of fractures cutting through both Baguio Gold diorite and early andesite. (See Fig. 2) Their texture indicates rapid cooling between definite sharp walls, as contrasted to the gradational, irregular contacts between early andesite and Baguio Gold diorite.

During the early stages of the late andesite intrusion, a plug of fragmental andesite breccia roughly elliptical in cross-section, 1,000 ft. on the minor axis by 1,700 ft. on the major axis, with sides of the conduit vertical, forced its way upward through the early andesite along the sedimentary contact. The andesite breccia contains scattered angular fragments of red chert and gray andesite in a matrix of fine-grain green andesite. Small, rounded fragments of volcanic ash have been observed at various locations within the plug.

Pliocene subsidence and deposition is represented by the coraline limestone at Mount Santo Tomas, near Baguio. Pleistocene uplift restored the islands to their present elevation. Recent volcanic activity of the explosive type is represented by red tuff deposits covering the andesites at many parts of the property at an elevation several hundred feet above the plane of the horizontal projection, Fig. 1.

The Age of the Fractures—A study of the field relationships and orientation of the various intrusives indicates that the forces responsible for the formation of the veins of the Baguio district became increasingly active during the later stages of the igneous activity. Fractures due to east-west compression began to appear in the Baguio Gold diorite soon after it had solidified. That the pressure was east-west and that the orientation of fractures was proper for stresses acting in this direction are discussed in subsequent paragraphs under "Theoretical Shearing." The N. 53 deg. E. strike and 81 deg. N.W. dip of these fractures indicate that easiest relief was up 15 deg. to the north. Pure theory for east-west compression indicates that for the N. 53½ deg. E. strike, the dip is 77½ deg. N.W. Late andesite dikes followed the fissures opened. Following intrusion and solidification of the fragmental andesite breccia, fractures in it were filled with the late andesite porphyry dikes. East-west compression was evidently becoming more intense, for the dikes are more numerous than those previous. The actual strike of from N. 43 deg. E. to N. 50 deg. E., and the dip of 50 to 65 deg. to the northwest, correspond with the theoretical position of fractures formed with easiest relief varying from 30 deg. to 45 deg. N. (See Figs. 3C and 3D.) Gradual accumulation of pressures and mass deformation at the close of the igneous activity resulted in the formation of the fractures responsible for the mineral deposits.

Theoretical Shearing—In a rock mass subject to an external compressive stress, failure takes place along planes of least resistance. On any assumed plane within that mass, the external stress may be resolved into components parallel to the plane, and perpendicular to it. The parallel components constitute a shearing stress. Perpendicular components constitute a compressive stress if they act against the plane, or a tensile stress if they act away from it. The intensity of the stress components varies with the magnitude of the stress and the orientation of the assumed plane with reference to the direction of compression. The tensile component is maximum on a plane oriented parallel to the direction of compression, inasmuch as the compressive component for this orientation is zero. Shearing components theoretically reach a maximum on two sets of planes making angles of 45 deg. with the direction of compression. The angle between the planes of shear is known as the angle of shear and is theoretically 90 deg. Actually it varies considerably from 90 deg. In brittle substances it is an acute angle; in plastic ones obtuse.

The Shearing at Baguio Gold

At Baguio Gold, the angle of shear is as low as 64 deg. as measured on joint systems at various locations within the main body of the diorite intrusion and believed not to have been distorted by later rotation. That the direction of pressure bisects the acute angle, on this property as well as elsewhere in the northern part of the district, is substantiated by the east-west orientation of tension fractures also bisecting the acute angle.

Dimensional changes within the rock mass subject to deformation are referred to three principal axes making angles of 90 deg. with each other. Shortening occurs in the direction of the axis of greatest compression, or along axis *CC* of Fig. 3A. Elongation takes place at right angles to the direction of maximum compression, or parallel to the direction of maximum tension. The axis of elongation corresponds to the axis *aa* of the figure. The intermediate axis (*bb*) makes an angle of 90 deg. with the plane containing the axis of elongation and the axis of compression. This plane is referred to as the plane of easiest relief.

Diagrams in Fig. 3 have been prepared by me to illustrate the effect of various inclinations of the plane of easiest relief on the position of shear and tension fractures appearing in horizontal sections. In Fig. 3A the plane of easiest relief is horizontal. Considering compression as acting east-west, tension fractures strike east-west and dip 90 deg. Based on an initial angle of shear of 70 deg., two sets of shear planes form, making angles of 35 deg. with the direction of pressure. Both planes are vertical; one strikes N. 55 deg. W. and the other N. 55 deg. E. Deformation along the shear planes is accomplished by movement in the direction of the arrows. Motion is parallel to the plane of easiest relief; hence striæ will appear horizontal. Two sets of shear couples acting in the plane of easiest relief are capable of producing the same effect as that of simple compression. They strike N. 55 deg. W. and N. 55 deg. E. as noted in the figure.

Using Fig. 3A as a basis, diagrams *B* to *H*, inclusive, illustrate the effect of rotation of the *aa* and *bb* axes around the *cc* axis. In Fig. 3B the plane of easiest relief is inclined upward 15 deg. to the north. Shear planes and tension fractures make an angle of 90 deg. with the plane of easiest relief. In a horizontal section they will appear as in the figure. One shear plane strikes N. 53½ deg. E. and dips 77½ deg. N. W., and the other strikes N. 53½ deg. W. and dips 77½ deg. N. E. Tension fractures strike east-west and dip 75 deg. N. As motion has taken place parallel to the plane of easiest relief, striæ on the shear planes as measured in the plane of the shear dip 8¾ deg. down to the southwest on the N. 53½ deg. E. shear plane and 8¾ deg. down to the southeast on the N. 53½ deg. W. shear plane. The arrows indicate the direction of the horizontal projection of the movement and the letters *U* and *D* indicate that the footwall or hanging wall has moved up or down in the direction of the arrow. Shear couples producing the same effect as that of simple compression now act in a plane dipping 15 deg. S. and strike N. 56¼ deg. E. and N. 56¼ deg. W. Other orientations of the plane of easiest relief are shown in the remaining diagrams. To use the diagrams for inclination of the plane of relief up to the south rather than up to the north, rotate the figures horizontally 180 deg. If compression acts at some other angle than east-west, orient the figure to the proper direction of compression and correct the direction of elongation and bearings of shear and tension fractures for this new orientation. For other sets of conditions, new diagrams must be prepared by application of descriptive geometry to the basic diagram Fig. 3A. Because various rock types vary in their ability to resist stress, it is probable that the

initial angle of 70 deg. used in preparing diagrams for this district may have to be altered to fit the conditions existing in some other district.

Vein Systems at Baguio Gold—Fig. 4 shows a portion of the Baguio Gold vein system. The irregular, *en echelon* nature of the 3 Vein West, as well as other field evidence, establishes it as a tension fracture. Individual oreshoots rake 45 deg. downward to the west. Strain ellipse 3 deg E. is placed at the intersection of the 3 Vein West with the 3 Vein East and oriented with one of the shear planes parallel to the 3 Vein East. Theoretically for this orientation, the 3 Vein West should strike N. 75 deg. W. and dip 35 deg. N. Actually, the general strike trend is N. 81 deg. W.; the strike of individual shoots varies from east-west to N. 51 deg. W.; the dip varies from 34 deg. N. to 38 deg. N.

The theoretical dip on the N. 54 deg. E. shear is 47¾ deg. to the northwest; actually the dip on the 3 Vein East varies from 44 to 49 deg. to the northwest. The complementary N. 24 deg. W. shear set has not formed. I know of no instance in the northern part of the district where the tension system has formed that more than one of the shear sets is present.

The 3 Vein East, typical of shear openings, is quite regular in dip and strike. Strong gouges occur on either footwall or hanging wall. Oreshoots are elliptical in longitudinal section as well as cross-section, are locally discontinuous, and rake to the southwest at approximately 45 deg. The vein roughly parallels the northwest flank of the diorite in both strike and dip. Mineralization is identical with that of the tension portion of the 3 Vein. Both shear and tension segments of the 3 Vein have been reopened by a continuance of the same stress which caused their formation. This later movement is responsible for the formation of gouges and heavy sheeting in the tension segment.

An examination of specimens of the vein filling shows that siliceous gold-bearing solutions entered channels in the calcite mineralization at this stage. The gold was quickly deposited in the angular openings and along irregular surfaces, due to the strong neutralizing action of the calcite. Quartz continued to be deposited in the openings. All available evidence points to high concentration of gold in the first surges, and continued deposition of increasingly lower-grade quartz. Small amounts of rhodochrosite and pink calcite indicate better than average values. An abundance of pyrite and a lesser amount of marcasite is associated with the late stages of the quartz surge. No other primary minerals have been noted in the 3 Vein shear or tension systems. I prefer to consider gypsum and anhydrite as secondary minerals, as explained in the paragraph on mineralization.

Referring again to Fig. 1, the 2A Vein West curves into the 3 Vein East after passing through the diorite at the plane of the section. The 2A Vein striking N. 70 deg. W. and dipping from 40 to 45 deg. to the northeast forms as a Baguio Gold occurrence of the complementary northwest set of shear planes. Strain ellipse 3E. is oriented for east-west compression near the 3 Vein East intersection with the 2A Vein in Fig. 4. The theoretical position of the northwest set of shear planes indicates that the strike should have been N. 39 deg. W. and the dip 47¾ deg. to the northeast. Apparently the 2A Vein is 31 deg. off strike. This discrepancy is explained by counterclockwise rotation due to continued application of force from the east and resulting deformation along the N. 54 deg. E. system with the footwall moving to the southwest. Such rotation is an essential part of the fracture pattern in the north half of the district and is fully discussed later.

The 2A Vein is an excellent example of the fact that rock types differ in their ability to resist stress. If there had been no difference in the internal resistance offered by the diorite and the andesite, the 2A Vein might never have formed. Since the direction of least resistance corresponded closely with the position of the northwest set of shear planes, this set was given local preference over the complemen-

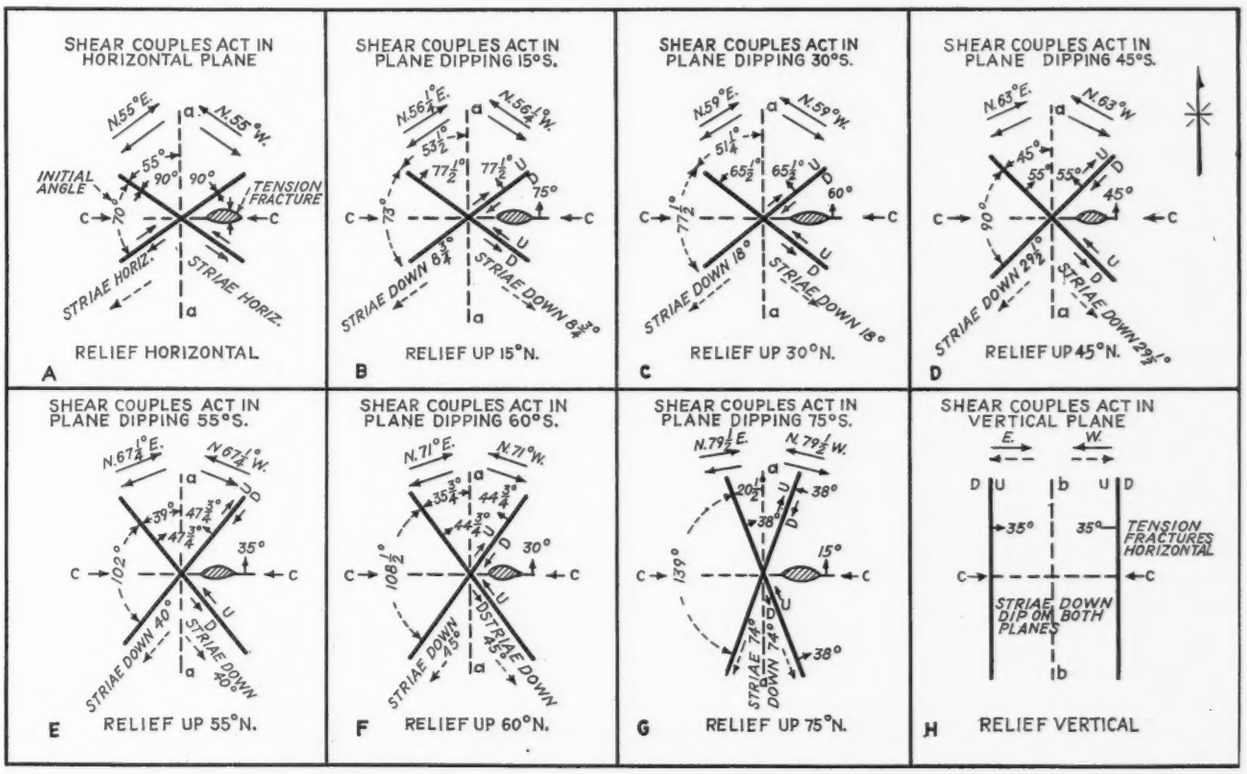

Fig. 3 . . . Horizontal sections showing position of shear and tension fractures under horizontal east-west compression with elongation up to north of various angles based on initial angle of shear, 70 deg.

tary northeast set. In that segment of the vein passing through the diorite the walls are tight. At higher elevations in this same area, the vein passes over the top of the diorite into the early intrusive andesite, with the resulting formation of a strong vein due to the more favorable shattering characteristics of the brittle andesite. Continuing along the strike of the vein to the southeast, the vein enters the andesite and opens up to a width of 15 ft. Direction of drag on the 2A Vein where it has been cut off by the 2 Vein checks the theoretical direction of motion for east-west compression.

Mineralization on the 2A Vein is identical with that of the 3 Vein. The systems are continuous and probably contemporaneous in their formation. Early calcite mineralization, late movements, sheeting, and introduction of siliceous gold-bearing solutions all substantiate this supposition. The direction of striæ on the gouges and naturally polished surfaces within the vein filling check closely with the theoretical.

The 6 Vein West is of the same type as the 3 Vein East. Fig. 3C is oriented for east-west compression in Fig. 4 to show its striking similarity with the actual position of the 6 Vein. Oreshoots rake approximately 60 deg. to the southwest, are locally discontinuous and typically elliptical in longitudinal section and cross-section. Present development work at the plane of the horizontal projection, Fig. 1, lies within the chilled edge of the diorite, which fractures well and is as favorable to vein formation as some of the early andesite. The 6 Vein H. W. Split is a combination of late tension openings near the 2 Vein with earlier northwest rotated shear planes which begin near the abrupt change in strike in the figure. Strain ellipse 3C is oriented for east-west compression in the vicinity of the 6 Vein, 2 Vein, 47 Vein intersection. Theory in this case, as well as in all cases where there has been no distortion due to later rotation, agrees most strikingly with the facts. Mineralization of the tension segment of the vein, like that of the 2 Vein, is predominantly quartz gangue. The tension portion was probably formed contemporaneously with the formation of the 2 Vein and the sheeting of the early calcite mineralization of the two complementary shear systems of the 6 Vein.

Valdez Vein represents the final stages of the early calcite mineralization and illustrates some of the phases of the lateral zoning in connection with changes in composition of the ore magma. The vein began forming at its northeast end; as mineralization progressed to the southwest, decreasing amounts of calcite were deposited. The appearance of siliceous gold-bearing solutions is represented by small, high-grade shoots. Pyrite and marcasite appeared in the later phases of the quartz surge. Final stages of mineralization are characterized by almost complete quartz filling, which become increasingly lower in grade as the fracture dies out against the 2A Vein.

The stage of fracturing represented by the formation of the Valdez Vein marks the beginning of sheeting and oblique slip-faulting on the 3 Vein East, 3 Vein West, 6 Vein, 2A Vein, 47 Vein, and others formed earlier. Striæ on the Valdez Vein gouges indicate that motion was from 5 to 8 deg. downward to the southwest. Orienting Fig. 3B in Fig. 4 for comparison, considering compression acting east-west and the plane of easiest relief inclined upward 15 deg. N., the dip, strike, and direction of striæ check exceedingly close. A better comparison of pure theory with actual fact would be most difficult. The 67 gold and high quartz content. Deposition of increasingly lower-grade quartz followed the southwesterly progress of the fracture. At the close of the dynamic activity, the quartz mineralization was almost barren. Fig. 3C, or strain ellipse *H* in Fig. 5, is oriented for east-west compression with easiest relief up 30 deg. to the north and illustrates another striking example of theory checking facts. Figs. 1 and 2 show the relation of the vein to the andesite breccia plug, the late andesite porphyry dikes, and the sediments. With both walls of the vein within the dike, fracturing has been especially favorable to vein formation and the concentration of values. Where the vein follows the hanging wall of the dike along the contact with the andesite breccia, values still persist, but the width decreases. With both walls of the vein in sediments, values are completely missing; the

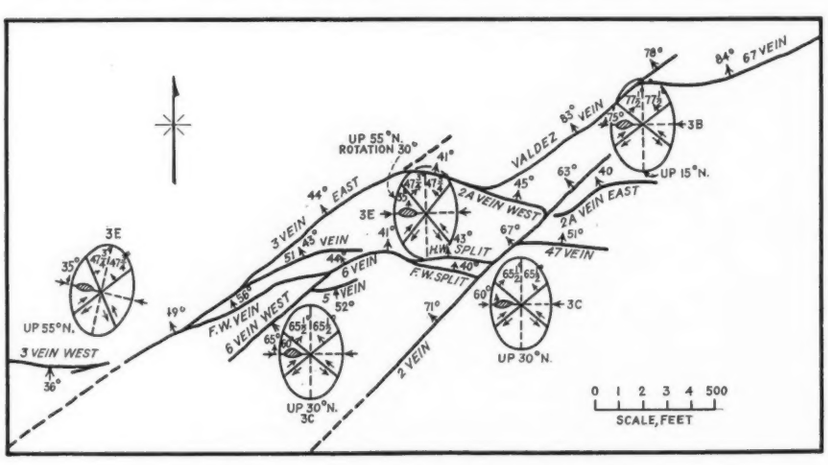

Fig. 4 . . . A portion of the Baguio vein system

Vein is oriented as a tension fracture, which well accords with the facts.

The 2 Vein began to form soon after, or perhaps contemporaneously with, the formation of the Valdez Vein. Mineralization is characterized by traces of galena, chalcopyrite, and sphalerite in a gangue predominantly quartz. Values are above the average. Post-mineral faulting along the 2 Vein displaced existing structures a minor amount.

Footwall Vein and 5 Vein are quartz-filled tension fractures opened during the Valdez Vein-2 Vein activity. The 2A Vein East is not a continuation of the 2A Vein West, but a distinct complementary shear.

Little Corporal Vein continued forming after activity on 2 Vein and Valdez Vein ceased. The vein began forming at the northeast. The sequence of mineralization and lateral zoning as the fracture progressed to the southwest is illustrative of the later phases of mineralization of the district. Late calcite mineralization gave way to mineralizing solutions of high structure still persists, but becomes weaker in depth.

The sedimentary contact, forming a natural plane of weakness, is probably responsible for the formation of the Little Corporal Vein at that particular location rather than either farther to the northwest or southeast. The vein is not a true contact vein, but takes an orientation dictated by east-west compression. Referring to Fig. 2 we note that the vein has followed the contact between the late andesite porphyry dike and the fragmental andesite breccia and has assumed the 45 deg. dip of the contact. It has steepened to its theoretical 66½ deg. dip while passing through the dike, whereas in the sediments the dip becomes flatter with depth.

Space prevents a discussion of the mineralization, age relations, and mechanics of vein formation of the 1,500, 51, 32, 47, Parallel, and Leonora veins as well as that of the Lonesome, Isabella, and Pittsburg structures. A study of each supports and confirms my theory of ground movements.

(*To be concluded*)

What Makes a Good Employee

Most of the attributes are purely personal qualities and can be cultivated by almost any one

E. S. Tillinghast
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IN LISTING the characteristics that go to make up a good foreman or a good worker in the ranks, it is something of a surprise to discover that most of those attributes are purely personal qualities rather than the result of education and training. They are characteristics that can be and should be cultivated by every one, no matter what his calling or station, and this should be an encouraging thought to the ambitious worker who feels the lack of education but is anxious to get ahead. This in no way belittles the desirability of education and training. Of course they are very important. But it does mean that acquiring an education is but a part of the preparation for life and its work and, perhaps, not so large a part as we are accustomed to believe. No amount of "book learning" can take the place of these very human qualities which every one may cultivate and the lack of which may be more of a handicap than lack of education.

A second surprise, though it should cause none, is to observe the similarity between the list that applies particularly to a worker and that for a foreman. But every employee is a possible foreman, and those qualities which constitute a good foreman will also help the worker to convert himself into foreman material. Foremen were promoted from the ranks because they were the best workers and had learned—consciously or unconsciously—to acquire most of the qualifications named. Other workers will be promoted for the same reason, for, in America, today's workers are tomorrow's foremen, superintendents, and managers. Almost every company, large or small, contains conspicuous examples of this.

It is impossible to list these characteristics in the order of their importance. Many of them are of equal consequence, and the need for certain qualities varies with the individual. Some are most in need of one thing, others of another and very different one. With this in mind we begin the list with willingness to learn.

No one ever attains to such perfection that he can no longer learn, both from his foreman and from his fellow workers. And no one is so dull or so ignorant that he cannot teach his brightest associate something. If he shows no positive virtue which should be imitated, he teaches negatively by illustrating what to avoid. Every man must maintain an open mind, ready and eager to learn from any one with whom he comes in contact. Neither pride nor diffidence should prevent him from making this a fixed habit. Too, he should be just as willing to help others as he expects them to be to help him.

If a man is honestly willing and anxious to learn, he will utilize every opportunity that offers to obtain information that has any relation to his occupation or interest. It may be possible to attend night school or some of the trade demonstrations that are frequently presented by salesmen and engineers for the companies they represent. If none of these methods is open to him, there is always a public library that contains helpful books and magazines, and he can do much to help himself—if he is sufficiently interested.

Cooperation must come early in a man's self-building if he wishes to succeed. The world's work is not done by a few "stars" but by the combined efforts of many men working together. Even though he does not fully understand or approve the methods employed, or does not like the man who gives him orders, he should contribute his best to the job's success. A man who does not cooperate is a drag, and a less efficient worker, plus cooperation, will be more effective and more useful than a more able one without this asset.

Alertness is but another step in the same direction. A man should keep himself alert and "on his toes" all the time: thinking of a better way to do the task allotted to him—one that is more safe or one that requires less time, less manual labor, or less material. If he feels confident that he has a worth-while suggestion to make, it should be presented to his foreman—not when the foreman is busy and hurried, but when he is relaxed and at ease and when it can be done appropriately, thinking of himself as a salesman with an idea to sell.

Because so many men are content merely to "get by," a man is required to do but little to make himself stand out from the rest: a little more interest in the job, a little more thought for the safety of himself and others, a little more quickness in anticipating orders and in following those given, will soon bring him to the attention of those above him.

Carefulness and dependability: These two attributes are so closely associated as to be almost inseparable and are most essential elements in the make-up of a man who aspires to become a foreman or who wants to be a better and more useful employee. Almost every gang of men contains some who, because they have gained a deserved reputation for being careful and dependable, are considered indispensable to the organization — a reputation well worth a considerable amount of trouble to acquire. They are traits which any one may build into himself if he wishes to do so.

The man who is careful will not do anything that may cause unnecessary danger or inconvenience to himself or to others. He will remember and observe all safety precautions and tactfully warn others who may be inclined to disregard them. Such a man, it is morally certain, will be found on his job during the hours when he is supposed to be there and doing his work with the same conscientious thoroughness whether the boss is near or not. For a careful man is almost always a dependable man.

Enthusiasm: A spirit of enthusiasm may not be an easy thing to bring to one's task day after day, even though that task is monotonously similar, but enthusiasm must be self-generated, in the mind and heart. No job is so uniformly tedious that something new and interesting does not develop in it daily, and if a man learns to look for things that arouse interest, they may be found in the simplest kinds of work. To permit himself to slump into a spirit of listless disinterestedness is to assist the advance of age and decline. To keep enthusiastic is

to keep young. Enthusiasm will send a man to his day's work each morning saying to himself, "This is my job, and I'm going to do it today to the very best of my ability." It will send him home at night, weary it may be, but content.

Temperateness applies not merely to drinking (though intemperance in that respect is most conspicuous), but to eating, amusements, and most other activities. No matter how good a man may be, if he does not possess good health his usefulness to his employer is destroyed every day that illness keeps him away from his job. To be temperate in all things is one of the best ways to insure good health. Every community contains examples of good men ruined by excessive drinking, but there may be just as many who are victims of overindulgence in other ways, not so easily discerned, yet just as dangerous to health. "Be temperate in all things" is still good advice.

Energy is one of the products of good health that should result from temperateness. An energetic employee need not try to do all the work of the gang to which he belongs, but he will keep busy. If, for a time, his own task does not require his attention, he will (because he is interested in the job) try to help some other man at his. In this way he is not only helping the job as a whole but he is helping himself much more by learning something about a different part of the business, making it easier to fit him into some other place when curtailment, expansion, or advancement makes that necessary or desirable. To realize the value of energy, one need only recall those men of his acquaintance who definitely do not possess it.

Courtesy: It is not necessary to carry under his arm a book on table and parlor etiquette for a man to be courteous. Courteousness is just another way of saying kindliness or thoughtfulness. If one has in his heart a kindly feeling for his fellows, it is just as certain to be shown in his manner as is the sun to shine through the clouds. To remain kindly and thoughtful when others may seem stupid, careless, or disagreeable may not be easy but it is bound to make the gang in which a man must spend a third of his time a more pleasant environment in which to work. It should be applied to fellow workers as well as to bosses and it will pay good dividends.

Smile: A smile is the outward evidence of a kindly spirit within, and no one thing helps more to make life pleasant. The man who does not smile is failing to contribute to the world's all-too-meager supply of sunshine and he is overlooking a most effective means of bringing himself to favorable attention. To smile when one feels blue requires an effort, but to do so acts as an antidote to his own blues and as a preventive to discouragement in others. A friendly smile given to another helps to make that person's day more enjoyable and, working inwardly as well as outwardly, it helps to make him who smiles more happy. To be an optimist, to smile, aids health, advancement, and happiness.

Pay and Profits Have the Same Source

Working for his employer's interest: Many a man fails to realize that his employer's interest and his own are, necessarily, the same. His pay MUST come from his employer's profits. There is no other source. No profits (sooner or later), no pay, no job. He and his employer are in the same boat, trying to cross the rough sea of competition to the harbor of profit. If they are not pulling together in the same direction, they cannot go forward. The man who fails to further his employer's interest at every opportunity, is—to just that extent—making his own job less secure.

Perhaps employers are partly at fault for the failure of many men to appreciate this, but it is a truth that operates constantly and, no matter where the fault lies, the result is the same.

A man may show his interest in many ways: making the best use of his own time; not taking other men away from their work by time-wasting gossip during work hours; by avoiding waste in tools and materials; being careful of the equipment which it is his job to operate, thus minimizing breakdowns and delays; and in countless other ways. And all this should apply whether his employer is an individual or a large corporation.

To put it briefly, he should think of the job as if it were entirely his own, with its success depending upon him alone.

The most gratifying thing is that the more thoroughly a man acquires interest and enthusiasm for his job the more completely has he succeeded in extracting a sense of drudgery and resigned indifference from his daily routine.

Neatness: A man should keep himself and the tools he uses as neat and clean as circumstances permit. This does not mean to be afraid of honest grease and dirt when his job requires him to get into them or to shun any part of that job because it is dirty. But the man who is naturally neat will look, even when he is dirty, as if he tolerated dirt rather than courted it. His tools will be kept in the place designated for them, sent for repairs when needed, and used for the purpose for which they were designed. Neatness does not require many or expensive clothes and it is not a difficult habit to acquire. To be neat is to be orderly—and it pays.

Safety has long since passed out of the realm of things to be talked about, then forgotten. There are few men today who are not completely sold on the idea of safety, but there is a great difference in the way it is practiced. To be effective, it must constantly be kept in mind—never overlooked for a minute. There are hundreds of ways for a man to be injured, but there is only one way for him to avoid accidents, and that is by being always on guard to avoid them, making himself his own safety inspector. Safety devices may be—and should be—installed wherever they can help, but, in the last analysis, it is up to the individual man to practice safety all the time, never relaxing his vigilance for his own welfare and that of others. No one else can assume this responsibility for him.

Rights against obligations: As an employee adds increasing years to his length of service with an employer, he naturally — and properly — considers that the years are gaining for him certain rights. These rights include a preference over other and younger men when a reduction in force is necessary or when promotions are to be made, consideration as to the choice of a job, and, in many companies today, vacations with pay. In addition he expects, and is usually shown, preferment in other ways.

All this is perfectly proper and as it should be, but he should remember that every right carries with it a corresponding obligation. Because he is an older and more experienced workman and, as such, is conceded these rights, he should feel it his duty to render a progressively increasing service. If he possesses the attributes of a good employee he will become a better and more productive one as time goes on and thus justify his claim to the recognition and appreciation he expects. If he permits himself to coast along on his length of service record without endeavoring to improve because of his additional experience, he will find younger and more enthusiastic men bettering his record and competing with him for the advantage he should be preserving.

This list of qualifications does not pretend to be exhaustive and there are many others that could be added and that will be considered by the thoughtful employee. The important thing to remember is that the cultivation of these and other worth-while qualities by a man, though bound to be of real benefit to his employer, will be many times more valuable to the man himself, on the job and elsewhere.

Reprints of this article, as well as of the author's earlier article, "The Boss and His Men," published in the June issue, may be had in multiples of 100 at a nominal price.

Designing Wooden Ore Bins With Timber Connectors

This device makes possible the use of a greater proportion of the working stress at the joints

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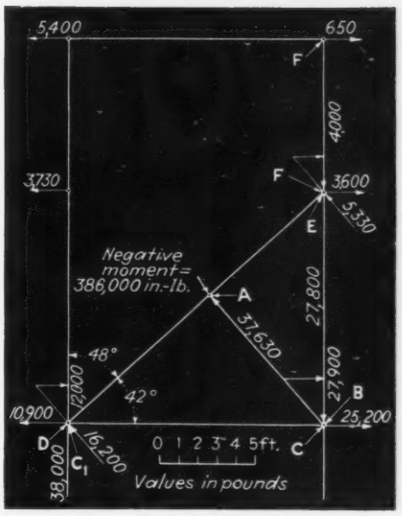


Fig. 1 . . . Location of the stresses at the various joints, in the design using timber connectors, is shown. The values are in pounds. The capital letters refer to the joint details given in Figs. 2 and 3

DATA for finding stresses in wooden ore bins were given by me in the article which appeared in the October, 1937, issue of *Engineering and Mining Journal*. A 100-ton bin was designed following the customary practice of framing the timber and holding the assembled structure together with bolts and tierods. In such construction, the nature of the various connections (end bearing, bearing perpendicular to the grain, tension, shear parallel to the grain, and related factors) seldom permits the full working-load value of timber to be utilized. In other words, because of the detail in joining wooden members together, a section larger than that indicated by column formulas and tension formulas invariably must be used. To overcome this, many types of appliances called "timber connectors[1]" have been developed.

These devices, depending of course on the design of the particular connector, permit the utilization of a greater proportion of the working stress at the joints. This means that the material size more closely approaches that indicated by the customary design formulas for compression and tension. The result is a considerable saving in lumber. The cost of the ironware remains about the same, although the weight may be less. Labor costs for fabricating and erecting are not available; however, indications are that they will be less.

Although the present discussion is devoted entirely to ore bins, it is worth while to call attention to the fact that timber connectors have been applied successfully to truss, bridge, platform, radio broadcasting towers, and other types of construction, and their use would lend itself readily to headframe design. Data regarding the application of connectors may be obtained from the Timber Engineering Company, 1337 Connecticut Ave., Washington, D. C. This type of design is readily adapted to temporary construction. By exercising reasonable care, structures may be torn down and reassembled with little damage resulting[2]. For highway construction or other jobs requiring portable bins, the use of timber connectors would appear desirable.

The accompanying illustrations show a 100-ton bin designed with the Timber Engineering Company's 4-in. split-ring connector. Its capacity, dimensions, and stresses are practically identical with those of the structure shown in the *Engineering and Mining Journal* of October, 1937. This similarity was decided on to permit comparison between the two types of design. The accompanying table shows the difference in size between the main members of the bins.

Fig. 1 shows the location of the stresses at the various joints. Their values are the same as used in the previous design. The capital letters refer to the joint detail shown in Fig. 2 and 3.

So that an approximate selection of sizes may be obtained, the following values were used (Douglas fir):

[1] "Manual of Timber Connector Construction," Timber Engineering Company, Washington, D. C.; "Modern Connectors for Timber Construction," Forest Products Laboratory, U. S. Dept. of Agriculture, Washington, D. C.; and "Wood Handbook," Forest Products Laboratory, U. S. Dept. of Agriculture, Washington, D. C.

[2] Whitlock, H. J.: "A Timber Lift-Span Bridge," p. 688, *Civil Engineering*, Vol. 5, No. 11, Nov. 1935.

A Tabular Comparison of Timber Sizes and Other Data for the Customary Design and the Connector Design

Member	Customary Design: Size of Timber	Customary Design: Bd. Ft.	Connector Design: Size of Timber	Connector Design: Bd. Ft.	Per Cent Saving
Front post	10 in. x 10 in. x 17 ft. 3 in. / 10 in. x 14 in. x 4 ft.	190	6 in. x 8 in. x 22 ft. 5 in.	90	52.6
Back post	10 in. x 10 in. x 21 ft. 3 in.	177	6 in. x 8 in. x 22 ft. 5 in.	90	49.2
Floor beam	10 in. x 14 in. x 17 ft.	198	2-4 in. x 16 in. x 20 ft.	213	7.6 loss
Diagonal post	10 in. x 14 in. x 7 ft. 6 in.	88	2-4 in. x 12 in. x 10 ft. 9 in.	86	2.3
Sill	10 in. x 16 in. x 14 ft. 4 in.	191	2-4 in. x 12 in. x 13 ft. 10 in.	111	41.8
Ties, front or back	8 in. x 8 in. x 19 ft.	102	2-3 in. x 6 in. x 18 ft. 3 in.	55	46.1
Ties, end	8 in. x 8 in. x 16 ft.	85	2-3 in. x 6 in. x 14 ft. 8 in.	44	48.2
Floor, sides, ends	4 in. x 12 in. x ——	4 per ft.	3 in. x 12 in. x ——	3 per ft.	25.0
Tierods, 1⅛-in. dia.	14 ft.	——	1	——	——
Total for each bin	.....	10,500 *a*	.....	7,300 *a*	30.5
Hardware	.....	1,850 lb.	.....	1,570 lb.	15.1
Approximate cost:					
Lumber	10,500 @ $25 =	$263	7,300 @ $25 =	$183	
Labor	10,500 @ $20/1,000 =	$210	7,300 @ $15/1,000 =	$110	
Hardware	1,850 @ 8½ c =	$158	=	$168	
Total		$631		$461	27.0

a Includes 10 per cent for framing

Compression (columns), $P/A = 1{,}200\ (1 - L/60D)$.

Bending in outer fiber, 1,466 lb. per sq. in.

Tension, 1,000 lb. per sq. in.

The joint connection being disregarded, these values gave members, in most cases, much smaller than later had to be selected because of the connector detail.

The problem confronting the designer when considering timber connectors is to provide sufficient end and edge margin, and center-to-center spacing for the connectors and remaining depth of timber after the groove is cut for setting the connector in place. This detail was obtained from tabulated data in the "Manual of Timber Connector Construction." Also, curves are given showing the permissible working loads for the various connectors at different angles. In the design of the present bin, timber sizes usually had to be increased to provide edge margin. To obtain uniformity in fabricating, only one size of connector was used. Several joints might have been designed with smaller or larger rings; this would have required different sizes of groove-cutting apparatus and bolt holds.

Referring to Fig. 2, all of the joints excepting *B*, *C*, and C_1 had been applied in practice. The use of the three specified had apparently not arisen. As seen in the drawing a 6x12-in. block was necessary to provide area for the connectors.[3]

The stress at *B* was resolved into components parallel to the face of the block and perpendicular to the back post. To counteract movement at the contact of the faces, three connectors were necessary. The bolts required were 1 in. In the lower end of this block three 1¼-in. bolts were needed to resist the tension of the sill.

Attention is called to the detail at *A*. Here, to provide area for the connectors, without increasing the size of the floor beams (the 4x16-in. members), a 4x12-in. center piece was inserted. At *B* it was necessary to use 2 to 3x12-in. pieces to shim the back post up to the thickness of the diagonal post. The short length of the diagonal would hardly permit the springing of its sides to fit the post. An even bearing of the connectors would not have been obtained.

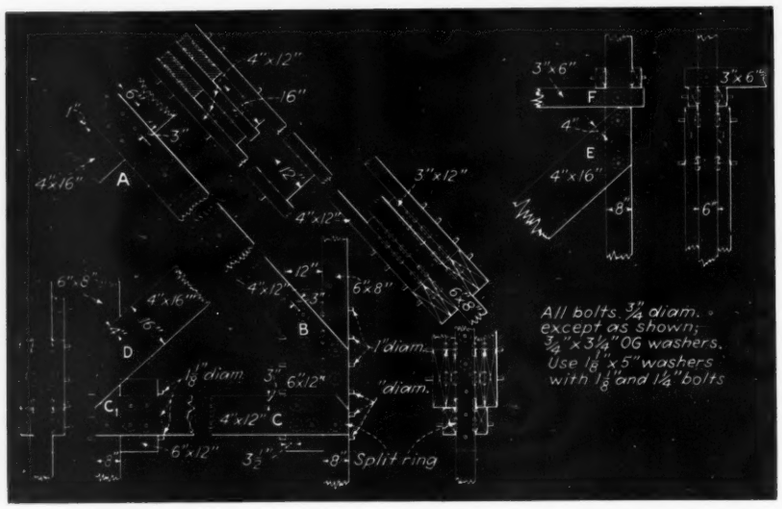


Fig. 2 . . . Joint detail from design of ore bin using 4-in. split-ring timber connectors

Fig. 3 shows the assembly of the bin. In section *y-y* is shown the floor beam. It will be noted that the ends have been sprung out slightly to take the posts. This was done rather then shim up the diagonal. The length here permits this with little distortion of the member.

Section *x-x* shows the detail required to get the side bracing past the floor beam.

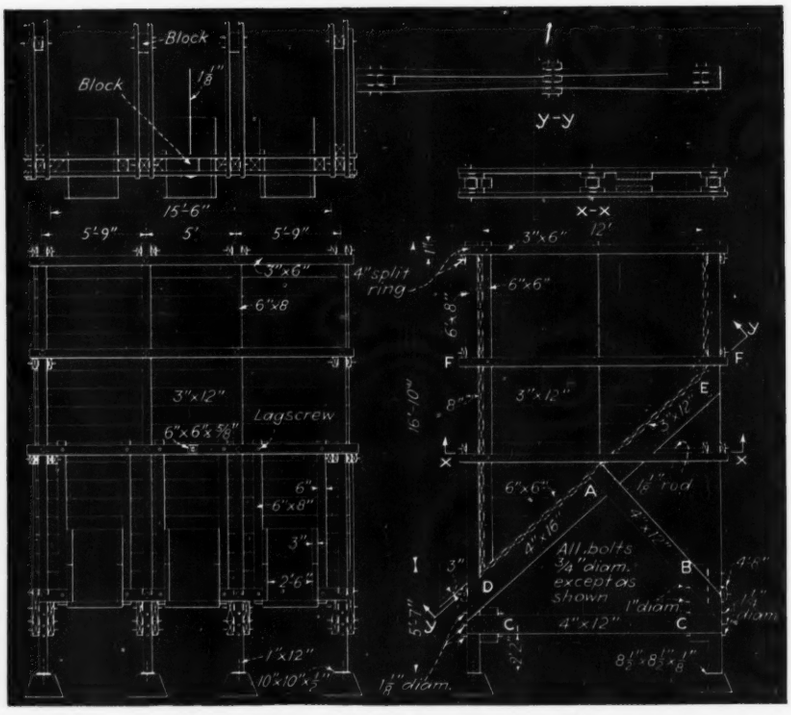
All of the minute detail required for spacing the connectors, depth of groove and related factors, has not been given. The purpose of the article is not to present a detailed design, but rather to call attention to the possibility of an economical saving made possible by using timber connectors.

In all, 380 4-in. split-ring connectors were required. Their cost is $16.24 per 100 in less than lots of 500.[4] This amounts to approximately $62. Tools for cutting the groove may be obtained at a nominal sum or they may be rented.

In estimating the comparative cost of the bin, a lower labor cost for the connector bin was assumed. This appears likely because there are no special timber cuts necessary. Offsetting this, however, is the cutting of the grooves. After weighting both considerations it was decided a saving of 25 per cent would be obtained.

Only one tierod was required. It was thought desirable to place one at about the center of pressure, as shown in Fig. 3.

Fig. 3 . . . Design of a 100-ton bin employing the 4-in. split-ring connector. This is the assembly of the structure, in three views, with two sections showing details



[3] This design was submitted to the Timber Engineering Company and received the company's approval. Communication from J. H. Carr.

[4] Communication from Timber Engineering Company, Jan. 20, 1939.

Testing for Tailing Losses in Placer Mining

Methods of continuous sampling for use on gold dredges are explained

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EXISTENCE of appreciable losses in the tailings from almost all placer mining operations is becoming recognized by an increasing number of operators. Only a few, however, have taken the pains to determine accurately the actual value of these losses, two essential reasons having blocked efforts in this direction: (1) The extreme physical difficulties that stand in the way of obtaining accurate and reliable results, and (2) the belief that, given the result, nothing can be done in practice to eliminate the loss; so why bother? Both reasons are untenable in the light of the recent advance in placer recovery methods, and the still more recent development of testing procedures. That existing losses are economically recoverable has already been pointed out in recent technical literature.[1] Moreover, a number of placer operators already concur in this belief, as is testified to by the ever-increasing number of large dredges in the western United States, as well as abroad, that are being converted to use the new recovery equipment. However, little or no attention has yet been drawn to the new methods of testing for tailing losses in existing placer operations.

Such testing will serve the useful purpose of gaging the efficiency of the recovery method employed, and when so conducted as to determine not only the magnitude but also the nature of the losses, a remedy for minimizing them is often indicated either by improving existing methods of recovery or by replacing them with others more efficient. Regular, systematic testing for losses in most concentrator operations has long become an indispensable routine. True, this has not always been the case. In the early days of milling when high-grade ores were predominantly treated, determination of what was being lost was often neglected, as what was being recovered assured a handsome profit. As the higher-grade deposits became depleted, those low in grade began to be worked, and the margin of profit narrowed. Percentage of recovery became an increasingly important consideration, and its exact evaluation served as a stimulus to metallurgical progress in the search for better efficiency in recovery of the metal won.

No reason can be given why this progress in realizing the need for systematic testing of losses should not analogously be followed by the placer miner. Great strides have been made in developing mechanical equipment to permit of operations on an enormous scale, with the attendant result of reducing unit costs and permitting exploitation of low-grade gravels. But here the analogy seems to stop. Not only has progress in recovery methods in placer mining been slow, but little effort has been made as yet to determine systematically and accurately the efficiency of the recovery methods which until recently were almost universally used. Yet there are many larger operations in which only 2c. or 3c. in gold recovered per cubic yard, and sometimes less, make the difference between profit and loss for the entire operation.

A prevalent and highly questionable practice of evaluating the placer recoveries is that of comparing the amount of gold recovered by actual operations with that determined to be present in the ground by preliminary sampling.[2] This yields recovery percentages varying widely from 50 to 200 per cent or more—figures that really evaluate nothing, and at best, when they are proudly claimed to be just more than 100 per cent, they merely give tribute to the conservative empirical wisdom of the man who sampled the ground, who made a good guess at the proper allowance for losses in the tailings of the projected dredging operation. What "hard" rock miner would be satisfied with the evaluation of efficiency in milling by comparing the amount of metal obtained from smelting his concentrates with the metal content as estimated by developing and sampling of the block of ore from which the metal was won?

With all due fairness, however, it should be stated that in sampling a placer tailing the placer miner is beset with many difficulties which rarely, if ever, confront the millman. The former cannot collect a bucket or so of pulp per day by intermittent sampling, dry it, cut it down, and then let the assayer make his determination, which can be taken as representative of the day's run. Were he to do that, no matter how refined his technique, he is doomed to failure.

The gold content of a placer tailing varies considerably because the distribution of the gold in the material mined usually is very erratic, as often it is concentrated in an irregular stratum a few feet thick in a total depth of gravel mined of as much as 100 ft., or the gold is concentrated mainly in pockets or crevices on bedrock. Consequently, the heads delivered to the placer recovery plant may vary considerably, from tens of dollars to a few tenths of one cent, or nothing at all, per cubic yard. In addition, the character of the gold in the ground often changes radically with depth, usually being finer in the upper strata, and percentage recovery may be considerably less there than in the lowest stratum where the gold is coarser. Although the gold content of the tailing from a placer operation perhaps will not vary between such wide limits as the heads, still the variation is so great even within short intervals of time as to perplex any sampling-wise millman. Moreover, a millman is seldom, if ever, confronted with the need of determinating gold values so small as those that occur in placer tailings. To a placer miner even a few tenths of one cent are important values, especially when the operating cost of recovering more, as by jigging, for example, is usually less than 0.2 cent per cubic yard.

Some dredge operators make an effort to sample the tailings now and again in order to check up on losses. However, the methods employed in the past were not only inaccurate, but were likely, more often than not, to give misleading results. Among the more common of these are: (a) Sampling a tailing pile; (b) taking grab samples from a flow of tailings; (c) using an undercurrent; (d) judging efficiency of sluice recovery from the daily clean-up of the last riffle at the end of the

tailing side sluices. The reasons for these methods being inaccurate and misleading are as follows:

1. Sampling of placer tailing piles is made difficult by the fact that the deposition of the pile usually is from a very much diluted pulp, and a run-off of a large volume of water takes place, causing a non-uniform segregation of values that can hardly be traced. In addition, the material often is deposited with the coarse screenings on top of the fine, and sinking shafts or drilling is rendered difficult by the tendency of the material from the sides of the drill hole or shaft to slough and run in. Because of these facts, and because the segregation of values is seldom predictable, sampling of tailing piles, if done at all, requires even greater care than sampling virgin ground—an operation that is both time-consuming and expensive.

2. Taking a single grab sample from a flow of tailings at any particular moment, even when such a sample is large, say a cubic yard or more in volume, should never be done for the quantitative determination of the tailing loss. As it has already been explained in one of the preceding paragraphs, the gold content of the tailings is generally too variable to have any assurance at all that such a sample would be representative of the average run of the tailings.

3. One often sees undercurrents used, especially in stationary placer plants and in hydraulic operations. The gold recovered in them cannot be taken as representative of what is actually being lost in the main sluice for the following reasons: (a) The stationary screening device used is not efficient, and a considerable proportion of fine material that is traveling even in the bottom layers of the flow may bypass this device without getting into the undercurrent. One has only to review the wide experience accumulated on the inefficiency of stationary screens to be convinced of the truth of this contention. (b) When only a part of the water in the main sluice passes into the undercurrent a sizable proportion of the fine sand and fine gold, especially flaky gold, usually remains suspended in the upper layers of the stream in the sluice and does not have a chance to pass through the screen. (c) Even when special precautions are taken, such as to widen out the sluice to reduce the water velocity ahead of the screen, the danger of losing a substantial part of the values because of the aforegoing two factors still remains.

4. Determination of the efficiency of the recovery in a riffled sluice by regularly cleaning up the last riffle at the end of each of the tailing sluices is a common practice. A similar but more complete method has been described in some detail by B. W. Bellinger (*E.&M.J.*, Vol. 132, p. 403, 1931). Although this practice gives a qualitative measure of the losses in the riffled sluice under given conditions, it affords no clue as to the quantitative loss of gold and as to what part of that loss can be recovered by the more modern and commercially practicable methods. Thus, on one dredge which showed a recovery of 4c. to 20c. per day in the last riffle of one sluice, the actual loss going over this riffle and recovered by jigs was $15 per day.

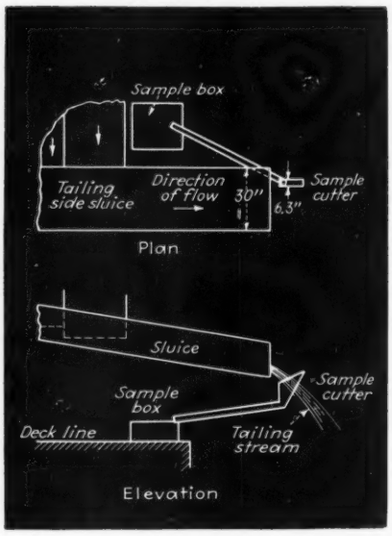

Fig. 1 . . . The arrangement of the cutter for intermittent sampling of tailings on a dredge

As a result of more than two years of close study of modern placer recovery methods, and the opportunity of making tests of many actual dredge operations with the cooperation of different dredging companies, the Pan-American Engineering Company has developed a continuous sampling method which has proved capable of determining placer tailing losses reliably and accurately. Before describing this method in detail it may be well to discuss an intermittent sampling method so designed as also to yield an accurate result when conditions are favorable. This will serve to illustrate more clearly the general problems incident to the sampling of placer materials, and to throw light on the reasons for the manner in which the continuous method of sampling is conducted. Incidentally, the intermittent sampling method to be described is of more than academic interest, as modifications of it actually have been used on several occasions with success. Accurate results can be had when it is applied intelligently and the work is conducted by someone fully aware of all factors to be considered.

Rather than discuss several possible modifications of this method of sampling, which might prove confusing, we can best illustrate the principles involved and the actual testing procedure by describing an example of sampling the tailings of a given, hypothetical dredge operation. The problem can thus be stated in its simplest terms, and the manner of determining some of the critical factors illustrated by actual figures.

Problem—To sample tailings of a 3-cu.ft. dredge digging 2,500 cu.yd. per day in ground 18 ft. deep, with upper 16½ ft. containing about 4c. per yard and lower 1½ ft. some $2 per yard, thus averaging over the entire depth of dredge section 20.3c. per cubic yard. Screen undersize, 50 per cent; equal distribution to port and starboard riffled tables. Time to complete a step, 120 min. Tailings discharged from one 30-in. sluice on each side of the boat, and expected to contain about 2c. per cubic yard of fines, representing the dredge loss. Desired accuracy of determination within 0.2c. per yard of fines, or 10 per cent.

Method of Procedure (See Fig. 1)—Every few minutes the sample cutter would be moved across the entire width of the stream discharging from the tail sluice, care being taken that it remain in the stream during each cut for exactly the same interval of time. The sample entering the cutter would discharge through a hose or pipe into a sample box. After the sample was cut, the pulp in the box was allowed to settle and the water decanted off. This prepares the box for the next cut, the sample being diverted into it. Such regular and frequent cuts would be made during an entire step, and the total sample thus accumulated, provided it be large enough and the cutting intervals be properly timed, would accurately represent the tailing made by the dredge during that step. The volume of the sample would be measured, then screened to remove the gravel, and the fines carefully streamed down in a long tom equipped with suitable matting capable of catching the finest gold. The clean-up from the long tom would be amalgamated and the amount of gold in the amalgam determined. The loss can then be calculated (from the weight of the gold recovered and the measured volume of the sample) in terms of cents in gold per cubic yard of fine tailings. Inasmuch as the ground dug during a single step is rarely representative of the entire width mined, usually several dredge cuts wide, this procedure should be repeated for each of the cuts, and the results obtained from each averaged in proportion to the yardage that each cut represents. In order that the described procedure be accurate for the hypothetical problem outlined in the foregoing paragraph, proper timing intervals must be adopted, and the size of the sample must not be less than a certain minimum. The following illustrates how these are calculated:

Frequency of Cutting Samples—In

order to keep the number of sample cuts of the two strata, one 16½ ft. and the other 1½ ft. thick, proportional to their thickness, at least 12 cuts should be taken during the entire step of 120 min. duration. If the rate of digging is equal (i.e., the number of buckets per minute is constant), the interval between sample cuts can be $\frac{120}{12}$ or 10 min. Only one of the 12 sample cuts should be taken while the dredge is digging in the pay streak. Since the latter represents only a small portion of the total digging depth, there is danger of either missing the sample in the pay streak altogether, or taking two instead of one. If this is done inadvertently, a serious error in the sample will result, which can be illustrated by the calculations given in Table I. Assuming the loss in the upper 16½ ft. to be 1.5c. per yard and in the lower 1½ ft. about 10c. per yard, and a total of 12 cuts made, the actual loss can be calculated and compared with the loss determined when a different number of cuts is made on the pay streak.

Table I—Effect of Number of Cuts in "Pay Streak" on Loss Determined By the Intermittent Sampling Method

	Actual Loss Weighted as to Depth	Determined Loss: No Cut on Pay Streak	Determined Loss: 1 Cut on Pay Streak	Determined Loss: 2 Cuts on Pay Streak
	16.5 x 1.5¢ = 24.8	12 x 1.5¢ = 18.0	11 x 1.5¢ = 16.5	10 x 1.5¢ = 15.0
	1.5 x 10¢ = 15.0	0 x 10¢ = 0	1 x 10¢ = 10.0	2 x 10¢ = 20.0
	18.0 39.8	12 18.0	12 26.5	12 35.0
	39.8 : 18 =	18 : 12 =	26.5 : 12 =	35 : 12 =
Loss.....	2.2 c. per cu. yd.	1.5 c. per cu. yd.	2.2 c. per cu. yd.	2.9 c. per cu. yd

Size of Cut—Assuming that samples checking within 1 mg. of gold are satisfactory (depending essentially on the maximum size of single particles of gold in tailing), then for 10 per cent accuracy a sample big enough to contain 10 mg. gold must be taken. Inasmuch as it is expected that the loss will be about 2c. per cubic yard, or 20 mg. per cubic yard, a sample of 0.5 cu.yd. solids will be sufficient.

Time of Cut—With 10 per cent required accuracy, and assuming that the cutter can be operated in and out of the tailing stream with a time variation not exceeding 2 sec., a 20-sec. cutting time is required—that is, for each sample taken, the cutter should be kept continuously in the tailing stream for 20 sec.

Size of Cutter—Average yardage of tailings passing over each side of the dredge (assuming 20 per cent swell and 21 operating hours per day) is

$$\frac{2{,}500 \times 1.2 \times 0.5}{21 \times 60 \times 2} = 0.595 \text{ cu.yd.}$$

per min. In twelve 20-sec. sample cut intervals, or 4 min., a total of 0.5 cu.yd must be accumulated, or at the rate of 0.125 cu.yd. per minute. Consequently, the cut must be $\frac{0.125}{0.595}$ or 0.21 of the total flow on one side of the dredge during the time the cutter is kept in the stream. Since the sluice is 30 in. wide, the cutter would have to be 30×0.21, or 6.3 in. wide.

Size of Sample Boxes—To preclude any loss of suspended values in the sample, it is best to accumulate in one box the entire sample from each 20-sec. cutting period. Assuming a dilution of tailing of 12:1 by volume, the total volume of such a box would have to be

$$\frac{0.595 \times 0.21 \times 13 \times 20}{60} = 0.54 \text{ cu.yd.}$$

or about 15 cu.ft. Two boxes about 3×3×2 ft. should be provided, so as to preclude any delays in cutting the next sample while one is settling and being decanted.

Use of the intermittent sampling method becomes complicated in the case of land-locked dredging operations, where there is only a comparatively small amount of new water introduced into the pond and the percentage of suspended solids in the pond water is great. Since there is then a considerable amount of fine solids in the water pumped and therefore recirculated on the dredge, the sample cut will contain these solids, and the measurement of the volume of the sample accumulated becomes uncertain. Corrections may be applied to reduce the possible error of measurement, but these are so difficult to establish as to cast doubt even on the corrected result.

Method of Continuous Sampling

Almost all difficulties in the intermittent sampling incident to erratic distribution of values, variations in the rate of feed, dilution, necessity of measuring the volume of the sample, and related factors, are automatically eliminated by using the continuous method of sampling. Briefly, the procedure consists in taking a representative cut of the total flow of tailings and subjecting it to a continuous recovery operation. This can be conducted for days, or even for weeks, at a time, and a result which is representative for the period during which the test was made is thus obtained. A technique has been developed which yields results that are accurate to 0.1 cent per cubic yard in uniform ground. In some cases, the test period was limited to about 16 hours and still yielded reliable results. Experience with a large number of tests indicates that the installations can be made easily and at low cost, and that the test work can be done without interfering with the normal operation of the dredge.

The new method of sampling dredge tailings is based on the generally accepted theory of sampling pulp flow applied universally in mills. Although automatic, movable samplers, which travel back and forth across the stream and maintain the cutter in the stream at all times, can be and have been used, experience has shown that results with stationary cutters are satisfactory. These have the distinct advantage of simplicity, low cost, and ease of installation, and in addition, require much less headroom than automatic samplers. The last-named factor is important on dredges where headroom generally is very limited at the point where tailings should be sampled.

When dredge tailings are sampled to determine the loss made by the recovery plant used, the places where the sampling is done, obviously should be in the side sluices at a point where the riffling stops. Usually, this is close to the stern of the dredge, where headroom is limited. In dredges where the headroom is so limited that convenient installation of the testing equipment is impossible, it may be necessary to take the sample forward of the point indicated, as, for example, at the end of the transverse tables just before they discharge into the side sluices. When the sample is taken here, the final results are corrected by the amount of gold recovered in the side sluices. As the latter sluices account for only a very small percentage of the total dredge recovery, the correction necessary is small. Sampling usually has been confined to one side of the dredge, but should the distribution of material and of the gold recovered in the sluices differ widely

Table II—Summary of Test Results With Jigging Continuous Sample Cut

A			B			C			D		
Hours	Total Cu. Yd. Jig Feed	¢ Per Cu. Yd. Jig Feed	Hours	Total Cu. Yd. Jig Feed	¢ Per Cu. Yd. Jig Feed	Hours	Total Cu. Yd. Jig Feed	¢ Per Cu. Yd. Jig Feed	Hours	Total Cu. Yd. Jig Feed	¢ Per Cu. Yd. Jig Feed
30:20	31.3	1.19	29:20	45.6	1.95	39:35	50.7	1.92	20:40	110	1.65
18:40	25.11	1.16	13:45	21.2	2.20	19:05	44.5	1.74	20:45	90	1.74
24:00	38.64	1.03	15:25	23.8	1.94	22:35	33.1	2.08	20:50	90	1.45
.....	.....	....	17:35	14.7	2.42	.....	....	....	.....	...	....
.....	.....	....	16.20	13.7	2.22	.....	....	....	.....	...	....

for port and starboard sides, sampling on both sides is indicated.

The sample cutters are so installed that the effected cut will be exactly representative of the total flow of tailings on the side of the dredge on which the testing installation is made. To obtain this when more than one sluice is carrying the tailings, the stationary cutters used are made of exactly equal width for each of the sluices on that side of the dredge, if the widths of the sluices are identical. In this way the cut taken by each cutter will be representative of its respective sluice. Then, the combined sample will be representative of the total flow, regardless of the variation in dilution, gold content, or amount of material in the different sluices, because the cut taken by any of the cutters bears the same relation to the cuts taken by the other cutters as the material flowing in any one sluice bears to that flowing in the other sluices.

In the preceding description it is assumed that the distribution of flow across the width of the sluice is uniform, which is not always the case, especially in a movable dry-land or a floating recovery plant. Owing to the change in trim normal to the axes of the sluices, the material flowing in them will often shift from side to side, causing heavier flow on one side than on the other. To minimize the error due to the non-uniformity of distribution of the material in a given sluice, three cutters, two on the side and one in the center, can be installed. All units should be of identical width. Fig. 2 shows such an installation. The size of the total cut taken for sampling will depend essentially on the size of the recovery equipment used. In general, the larger the cut taken the more accurate the results will be. However, results have been quite satisfactory with a cut as low as one-twenty-fifth of the total flow of the tailings sampled, and it is conceivable that, if sampling be continued over a long period of time, even a lower ratio of cut to the total tailing could be used without impairing the accuracy of the results.

Choice of the recovery equipment to be used for treating the continuous sample cut, taken as described in the preceding, is determined largely by the purpose which the testing should serve. If, as is true for the majority of operations, testing is expected to serve the purpose of determining the gold loss that can be recovered by existing and practical methods of recovery, then the equipment used to treat the sample cut should be such that the results obtained can be duplicated in practice by a full-size installation. At present the only equipment that can be seriously considered is something similar to already proved gravity concentrating devices for primary concentration, with amalgamation as the final stage. On the other hand, if the purpose which the testing should serve is to determine the absolute value of the material being discharged as tailings, then the method used cannot be confined to gravity concentration and should ultimately include the final arbiter

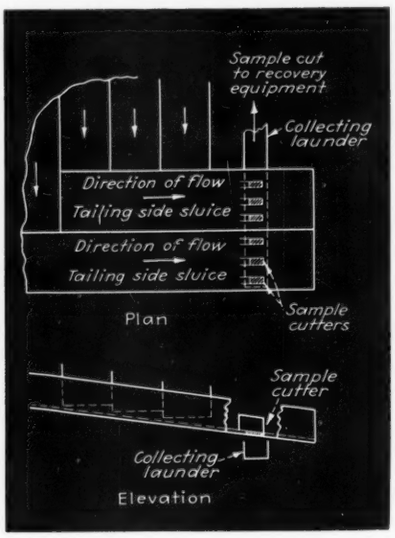

Fig. 2 . . . Cutter installation for continuous sampling of dredge tailings

for the determination of gold in solid materials—fire assaying. There are different ways to achieve this, but inasmuch as this is outside the realm of the usual requirements of dredge operators, it will not be discussed further. Suffice it to say that testing to achieve this purpose has been undertaken in the past,[3] and methods that could be used to this end are fraught with many pitfalls and difficulties, which tend to make the reliability of the final results questionable. The following discussion is therefore confined to methods that give determinations not of the absolute loss, but of that which is recoverable by gravity under optimum conditions.

One of the simpler of such methods applicable for the determination of the values contained in a continuous sample cut is that of passing it over a sluice fitted with riffles or suitable matting covered by expanded metal, the flow of the material in which, and the slope and width of which, could be regulated to give optimum recovery. It must be said, however, that regardless of the best regulation made, there will be times when such a sluice will not be working at its maximum efficiency. The causes for this happening are the same as some of those responsible for the loss of gold over the riffled sluice on the dredge —namely, the variation in the feed as to volume and dilution, presence of black sand that causes packing in the riffles, and the change in the trim of the dredge, resulting in corresponding changes in the velocity of the pulp flow, with attendant alternate scouring and sanding up of the sluices. These changes in trim are bound to occur to a certain extent no matter whether the test sluice is placed fore and aft or athwartship. The main argument against the use of this method of testing is that if the determination shows an appreciable loss to be existing, it is seldom possible to correct it on the dredge by installation of additional riffle area, as most dredges already are equipped with the maximum possible riffle area. Consequently, a test conducted by this method would have only an academic interest, and its usefulness would be confined essentially to giving a clue as to whether or not the existing dredge recovery is as efficient as the equipment used will permit. True, as a result of such test work certain regulations of operating conditions in the existing sluice layout can be undertaken in an effort to improve the recoveries made.

Another method, which does not involve the objections outlined in the preceding, has been used to test many dredges in the past two years. It is the use of jigs to treat a continuous sample cut. When properly applied the practice is free from objections inherent in the use of riffled or matted sluices. Variations in the trim of the dredge, and variations in the feed to the jigs as to quantity and dilution (so long as ample jig capacity is installed), do not appreciably affect the recovery made by such equipment. As already pointed out at the beginning of the article, it is a well-established fact that additional recovery can be made on a dredge by the use of jigs. Consequently, if the test is undertaken with jig equipment so designed as to yield results that can be converted accurately into terms of actual practice with a full jig installation, such tests should have a definite practical value and should yield not only a result of academic interest but also one which should imply a practical remedy. Repeated applications of this method on more than one dozen dredges throughout the world have demonstrated its value and reliability. The remaining paragraphs, therefore, will be devoted to the description of this method. This is a development that has been tried repeatedly and proved practical. In addition it has been responsible for a number of dredge operators modernizing their dredges by equipping them with complete jig installations. Where opportunity for comparing the test results with the actual additional recovery of a full jig installation has presented itself, it has been found that the two agree closely.

Fig. 3 shows the flowsheet of a jig test set used on a continuous cut

of dredge tailings. When headroom is available, which is seldom the condition, the flow through the entire installation can be by gravity. Elevation of pulp, however, usually will be required at one or more points in the flowsheet. Size of the equipment depends on the size of the total cut to be made by the sample cutters. When a comparatively small cut is taken—say 1/20 or less of the dredge tailing—a small rougher jig only 10 or 12 in. wide can be used, but of a length that is closely comparable to that of the jigs of standard size used in complete jig installations on dredges, should the losses determined be found sufficient to warrant it. In such a case, the flow to the treating unit can usually be made by gravity from the sample cutters. Beyond this, however, inasmuch as the rougher jig probably would be placed on the deck, the concentrates made by it would be elevated by suitable means to the dewatering cone ahead of the cleaner jigs. This can be done conveniently and simple by a jet pump actuated by high-pressure water available on all dredges. When a standard size rougher jig is used for testing, the sample cut taken can be considerably greater than that designated previously, or as much as 1/5 to 1/10 of the total dredge flow on one side of the dredge, depending on the size of the dredge. Since standard jigs require appreciable headroom, it is generally necessary to elevate the continuous sample cut to the jigs. Centrifugal gravel pumps are being used for this work.

To make the results obtained by a jig test installation strictly comparable to what may be expected of a full installation of jigs next to the screen, it may be advisable to dewater the test jig feed to the dilution which would obtain for a full jig installation. Dewatering is desirable for the reason that the tailings as sampled contain the entire supply of both high and low-pressure water used on the dredge; yet, when jigs are applied and installed next to the screen, only the high-pressure water entering the screen need be used, and no low-pressure water outside of the screen would be necessary except that required for the hutch water in the jigs. As a consequence, the continuous sample cut should be dewatered to the dilution that would obtain with only high-pressure water being used in the screen. Generally, this dilution is 6:1 by volume, whereas the dilution of dredge tailings is 12:1 by volume. Thus, the amount of water to be discarded in a dewatering tank would be 6 parts of water to 1 part of solids by volume.

As shown in Fig. 1, the sample cut is passed continuously over the rougher jig for a given interval of time, which generally has been at least 16 hours, but can be as much as two weeks or longer. The rougher concentrate is drawn continuously and elevated to the dewatering cone. Dewatered material is re-treated in a cleaner jig, the hutch product being accumulated for the period of the test and then cleaned up, usually by amalgamation, for the recovery of the values in it. With rougher jigs, either the full size or the small size installation being used, a ratio of concentration of 30 to 100 to 1 is generally possible; and with cleaner jigs a ratio of concentration of 20 to 50 to 1 on the rougher concentrate is made. Thus, an over-all ratio of concentration of 600 to 5,000 to 1 cuts down the final concentrate to be amalgamated for the recovery of gold to a very small bulk, so that the clean-up of the final concentrate becomes relatively simple. In the event the small rougher jig equipment is used, the cleaner concentrate will amount to less than 1 cu.ft., or about 150 lb., of concentrate per day. As to the large installation it may be as much as 8 cu.ft. of concentrate per day, but seldom more.

The simplest way to make a clean-up is in an amalgamation barrel, which affords easy and fully controllable amalgamation of values, regardless of their physical condition. Even when

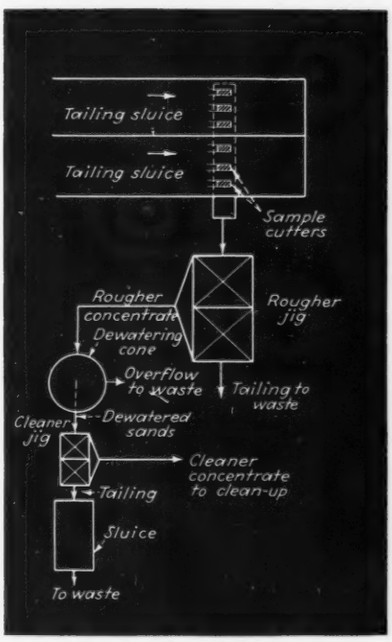

Fig. 3 . . . Flowsheet of test-jig installation for continuous sampling

the gold is rusty or greasy, or extremely fine, this method effects the best amalgamation of the gold contained in the products, inasmuch as is permits grinding the concentrates. if necessary, and the use of chemical agents such as cyanide, lye, or acids. It has been found to be preferable to the use of amalgamation plates alone. Sluices with matting covered by expanded metal behind the rougher and cleaner jigs generally are used to check the work of the respective jigs. Recovery by such equipment behind the jigs is always favored because the coarser portion of the heavy materials, such as black sands, is substantially removed by the jigs. Consequently, the tendency towards packing riffles or the expanded metal with heavy sands is considerably reduced.

To calculate the result of the test in terms of cents per cubic yard of jig feed, the total yardage passed over the rougher jig during the entire period of the test should be determined. The yardage can be calculated from the total time of the test and the average rate of feed to the jig during the test. The rate of feed can be determined by either of two following methods:

1. Direct measurement, repeated often enough during each day to give a consistent average for that day. This can be done by diverting for a timed interval the entire flow of the jig tailing or the jig feed into a large box, and then measuring the volume of the solids thus accumulated.

2. By calculation from the percentage of the total yardage dug by the dredge that the cut tested represents. The total yardage mined can be determined accurately by surveying periodically the advance made by the dredge.

As the record of the yardage dug by a dredge is kept by almost every dredging company, the second method of arriving at the yardage tested seems the simpler one. Where the cutters are installed as described previously, it has been found that the cut they take is so representative that determining the test yardage by the second method gives accurate results. This has been actually checked against the method of measurement. The following is an example of such a check made on one of the tests conducted on a large dredge in 1938:

The dredge had double-decked tables on each side, and each of the 4 tables carried about 25 per cent of the total gravel passing through the screen. Owing to a special type of distributor installed, distribution between the two sides, as well as that between the upper and lower decks on each side, was practically equal. The following summarizes the conditions obtaining on the dredge, and those characteristic of the test installation: Percentage of undersize in the material dug, 50; percentage of material on the deck tested (two decks on each side) of the total undersize, 25.33 (by actual determination); width of each cutter used in the test, $1\frac{5}{8}$ in.; total number of cutters used, 15 (3 for each of five sluices); width of sluices between riffle wedge bars, $27\frac{1}{2}$ in.; total dredge "bank" yardage

from beginning to end of the test, 140,669 cu.yd.; and total net operating hours of the dredge for test, 322.17 hr.

Calculation of percentage cut:

$$\frac{1\frac{5}{8} \text{ in. x } 15 \text{ x } 100\%}{27.5 \text{ x } 5} = 17.75\%,$$

representing the percentage of sample cut of the deck tested.

Total yardage cut by sample cutters:

$$\frac{140{,}669 \text{x} 0.50 \text{x} 25.33 \text{x} 0.1775}{322.17} = 9.82 \text{ cu.yd.}$$

per hour, cutter "bank" yardage of screen undersize.

To check this figure it was decided to determine it by direct measurement. Rougher jig tailing was measured by catching all of it in a large box for 15 sec., allowing the sands to settle completely, decanting the water, and measuring the volume of solids. It was found very important to allow ample time for settling of the solids, as there was a large amount of very fine material in the ground (about 25 per cent of the screen undersize by weight was minus 100 mesh). Ten measurements on one day averaged 9.60 cu.yd. per hour, and 20 measurements the next day, representative of an entire step, averaged 9.70 cu.yd. per hour.

To arrive at the amount of material passing through the cutters, in addition to the amount of jig tailing as measured in the foregoing, it was necessary to measure the amount of rougher concentrate as well as the amount of fine solids overflowing from the dewatering cone ahead of the rougher jigs. The average amount of rougher concentrate was 0.28 cu.yd. per hour, and the average amount of solids in the dewatering cone overflow was 1.1 cu.yd. per hour. Therefore, the yardage entering the sample cutters, as determined by direct measurement, was:

	Cubic Yards per Hour
Rougher jig tailing.....	9.65
Rougher jig concentrate.....	0.28
Dewatering cone overflow....	1.10
Total measure yardage, "swelled"	11.03

The swell of the ground was determined accurately on material representative of the screen undersize on the dredge both as to character and size. This determination gave 13 per cent swell for the fines. Thus, measured yardage corrected for swell becomes:

Measured "bank" yardage of cut of screen undersize: 11.03:1.13 9.76 cu.yd. per hour.

Calculated "bank" yardage of cut of screen undersize: 9.82 cu. yd. per hour.

The agreement between the calculated and the measured values is excellent, and points to the fact that the method of calculation of the sample cutter yardage from the percentage cut and the total yardage dug by the dredge was reliable. Having the yardage rate to the rougher jig, the total operating time, and the gold recovered from the clean-up during the test interval, the loss in cents per cubic yard of dredge tailings can be calculated accurately.

There is an important advantage of using the method for calculating yardage passing through the cutters rather than determining the yardage by measurement—namely, it can be applied to calculating directly the loss in terms of cents per cubic yard of "bank" measure of actual dredge section, thus eliminating such factors as swell and the percentage of oversize in the ground rejected by the screen and the stacker. Elimination of these factors is predicated on the assumption that all values in the ground pass through the screen and there is no loss over the stacker; also, that distribution of material between two sides is uniform. With these assumptions, the percentage of cut as calculated on the basis of the total width of the cutter openings, and the total width of all tailing sluices on the dredge, can be applied on the total "bank" yardage dug by the dredge as measure by periodic surveys and corrected by the total interval during which the test was conducted. Using the figures given in the preceding example, this calculation would be as follows:

The percentage of the total width of all side sluices on the dredge (20 sluices, or five on each of the four decks) which the total cutter width represents:

$$\frac{1\frac{5}{8} \text{ in. x } 15 \text{ x } 100\%}{27.5 \text{ x } 20} = 4.44 \text{ per cent}$$

Cutter yardage in terms of "bank" measure: 140,669 x 0.0444=6,245 cu. yd. of equivalent "bank" measure of cut for period of test. This figure can be divided into the total value of gold recovered during the test (322.17 hours) to arrive directly at the loss in the dredge tailings as determined by the jig installation in terms of cents per cubic yard of "bank" measure.

The method is correct and if it is intelligently applied the results will be reliable. A day-to-day variation in the amount of gold per cubic yard of feed recovered by the test jigs should not be interpreted as indicating any inaccuracy in the method. It merely shows a corresponding variation either in the unit value of the ground being dug, or a variation in the efficiency of the sluices due to changes in the character of the ground. However, in fairly uniform ground, good checks have been obtained, as Table II summarizing four different test jigs on dredge tailings indicates.

There are three purposes to which this method of testing placer materials with jigs can be applied.

1. To test tailings of dredges to determine the existing dredge losses recoverable by practical methods. When the loss is determined, it can serve as a basis for a decision as to the advisability of equipping the dredge with jigs. Experience with jig-operated dredges has shown that such installations are warranted, and their cost is completely amortized within reasonable time, even when the loss is as low as 1c. per cubic yard of undersize, or about 0.5 cent per cubic yard of "bank" measure.

2. To test tailings on any placer operations in order to have a check on the efficiency of existing recovery equipment. This can be used not only to test riffles, sluice tailings, but also to test the efficiency of jig equipment on a dredge where already installed.

3. The continuous sampling method with jigs could easily be adapted for use as a "permanent" installation on dredges to make regular and systematic checks on the gold content of tailings, or, for that matter, on dredge heads as well—much for the same general purpose as regular sampling and assaying are done in mills. Though it may seem premature to advance the suggestion at this time, the commercial usefulness of providing for a metallurgical control on a dredge will without doubt eventually be realized by most progressive dredge operators.

Also, jigs can be used to advantage for testing placer ground. When applied to the recovery of gold from shaft or drill samples instead of having such samples panned or passed over a long tom, the results obtained will not need the "recovery correction" usually made, provided, of course, that a jig-equipped dredge is planned for the ultimate operations. Moreover, the use of test jigs in recovering gold from the samples will eliminate almost entirely the personal equation that enters so importantly when employing a "panner" to pan the samples, and even in operating a long tom.

Apart from permitting accurate quantitive determination of values recoverable by jigging, the jig testing described in the article can be made to furnish many additional data, such as quantity of heavy materials in the ground, character of the gold to be saved and its amenability to amalgamation.

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The four cuts here seen, one above the other, were made with the bulldozer shown in the accompanying picture

Exploring Drift-covered Areas With a Bulldozer

Method found advantageous as to cost and efficiency in Sandon camp, British Columbia

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Nelson, B. C.

UNEXPLORED drift-covered areas that are worth investigating are usually to be found in almost any old mining camp. In times past, the cost of effective prospecting was prohibitive, with the means then available.

Such was the situation at Sandon, British Columbia, an old silver-lead-zinc camp with an impressive record of both production and profits. For some years I had an area under observation in this camp. It was literally surrounded by the best producers of the district, but it was covered with overburden and a forest was growing from the latter. Numerous test pits and trenches had found nothing. Water in quantity for ground sluicing was not available. In 1936 I had my attention drawn to the effectiveness of the bulldozer under certain conditions and decided to experiment with one on this area, if the ground could be assembled. This was accomplished and the work started as soon as the snow was off in 1937.

Results were so satisfactory that we now have a mine in course of development. The cost of this method of prospecting is so much less than anticipated, and the results are so gratifying that I feel the data should be passed on to others who might be interested in a similar development. Our over-all cost for two months' work was approximately 10c. per cubic yard of rock and earth moved. The average depth of overburden was about 4 ft. and occasional cuts were as much as 20 ft. deep.

The area to be prospected was a typical Slocan mountainside between elevations of 4,000 and 6,000 ft. above sea level. The rocks are slates, limestones, quartzites, and argillites, with occasional bands of igneous intrusives. Part of the ground had been burned over many years ago and was covered with a husky second growth and some standing dead timber. The rest was virgin forest.

Our preliminary work was to lay out a main trunk cut across the prevailing strike of the productive veins of the district. This cut was on a grade such that it might later be utilized as a truck road. The plan was to get this cut well into the solid and to make all subsequent cuts from the trunk cut. The machine used was a 60-h.p. diesel tractor equipped with an hydraulic bulldozing blade.

A driver and swamper for the machine and an observer on each shift comprised the crew. Two axemen and two miners with hand steel were used on the morning shift. We found that four men were sufficient to keep the machine working steadily.

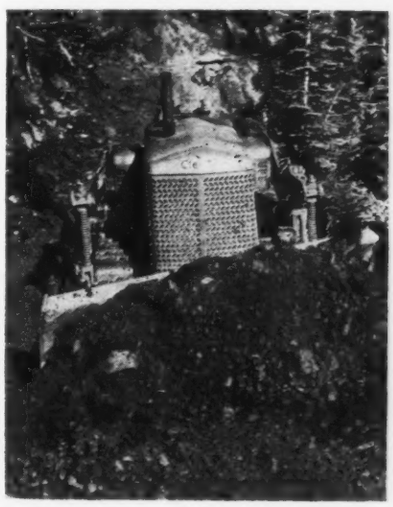
The procedure was to start at the highest point and work down hill, as the bulldozer is much more efficient when assisted by gravity. The preliminary cut was run ahead until the machine encountered some natural obstacle; while this was being removed, the driver went back and widened his cut to bedrock. The observer, who needs to be experienced, followed behind the caterpillar and examined the freshly exposed bedrock for signs of mineralization. Incidentally, ore is usually first found by watching where the caterpillar treads break up the small rocks.

We tried to reach bedrock all the way in our trunk cut, but there were a number of places where we did not reach the solid. We later drove a crosscut under this area and found that each of these soft spots consisted of either veins or faults. One should not be satisfied with one cut but should make several. We found that the outcrop of even strong veins is remarkably discontinuous on surface and is often masked by ancient rockslides.

All timber that may fall on the machine or driver when undermined, must be cut. Any tree without a tap root, such as a cedar up to 2 ft. in diameter, is easily shoved over if directly in the path. It is advisable to blast all stumps over 18 in. in diameter to save time. Brush and small timber may be ignored.

This method of prospecting no doubt has definite limits of application, but in a mountainous district steep enough to afford an overcast, and where the rocks are not too hard, it has been demonstrated to possess many advantages from the viewpoint of both cost and efficiency.

A bulldozer at work on a typical Slocan mountainside at the camp of Sandon, British Columbia.



USEFUL OPERATING IDEAS

Inspecting Wire Rope

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THE METHOD USED by the American Zinc Company of Tennessee, at Mascot, Tenn., for inspecting rope, of both the standard and the pre-formed type, is one devised in the company's shops and which it has been using for several years. Two men customarily inspect all hoisting equipment once a week. This is done on Thursday morning. The cables are gone over near the points at which they are attached to skip or cage. They are then inspected at the hoist drum by being run off and cleaned at various places, those doing the work meanwhile looking for broken wires. Recently another scheme has been tried. It consists of cutting off a piece of the wire rope starting at the loop where the pin goes through, and then about 4 ft. above the upper clip.

Two pieces about 18 in. are thus removed, the strands taken apart and inspected for broken wires. Such an inspection was recently made on one of the skip ropes. After being in service about one and one-half years, and hoisting approximately 500,000 tons, it was found to be in good condition, with no broken wires. This was $1\frac{1}{8}$-in. pre-formed rope and was used in hoisting a skip with 4 tons of ore a distance of 600 ft.

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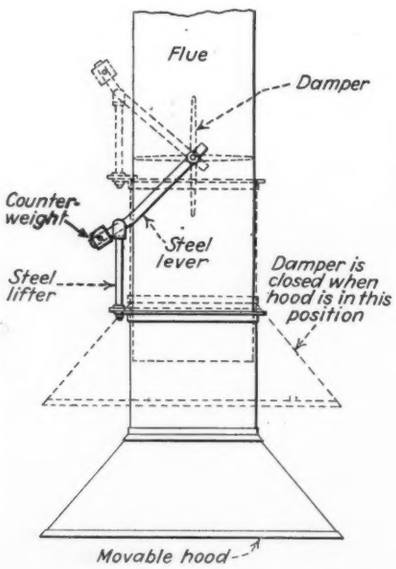
Self-Closing Flue Damper

TO avoid having flues open while cleaning discharge spouts and other furnace auxiliaries, the mechanical department at the Selby smelter of the American Smelting & Refining Company, Selby, Calif., installed the self-closing damper in the different smelting departments. Its construction is explained in the accompanying drawing. It is simple in design, dependable, and the required parts can be made cheaply from scrap. The description here given has been supplied by William Rams, master mechanic.

Briefly described, the arrangement consists essentially of the damper proper installed in the flue and the operating mechanism. The damper remains open as long as the movable hood is in normal position. When work has to be done in the area below the hood, the damper in the flue is automatically closed by the steel lifter on the hood flange as the hood is raised by the operator to provide additional headroom. The counterweight on the steel lever attached to the damper shaft again returns the damper to its open position the moment the hood is lowered.



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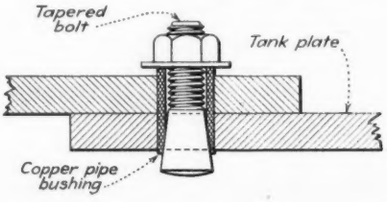
Repairing Leaks In a Tank

OCCASIONALLY, the mine and mill repair man is confronted with emergency repairs on tanks or air compressor receivers in the nature of leaks caused by improperly placed rivets. Any delay in repairing these defects in many instances would be a serious matter, especially if the vessel in question holds gold-bearing solution, chemicals, or oils. In addition, the hole in which the rivet rests, if allowed to leak any length of time, may corrode to such an extent that a costly repair is necessary. The method explained in the accompanying sketch has been used on many occasions to stop leaks quickly and effectively in tanks and pressure vessels. It is simple and inexpensive, and involves the manufacture of a steel bolt with a tapered end and a short length of copper tubing. Both are placed into the cleaned hole as indicated, the hole being automatically sealed by the copper bushing pressed down and sideways by the nut when tightened and the tapered end of the bolt.



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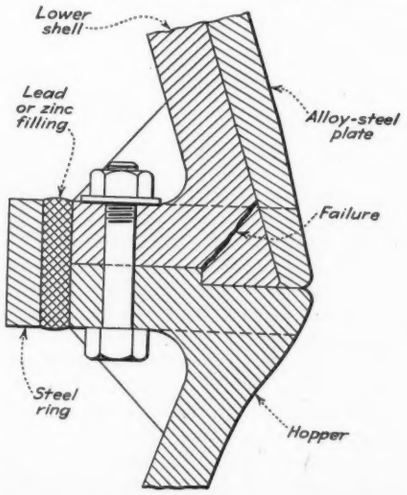
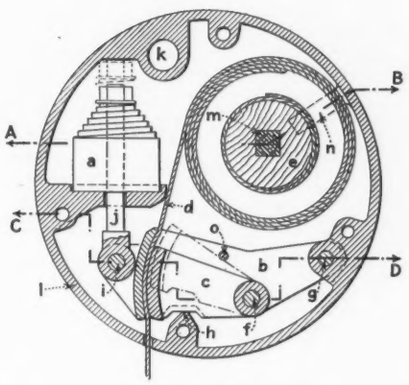
Repairing a Gyratory Crusher

AN INEXPENSIVE and quick repair job on a large gyratory crusher that averted a lengthy shutdown at the crushing plant of the Tom Reed Gold Mining Company, Oatman, Arizona, is illustrated in the accompanying sketch. Interruption of crushing was threatened when an incipient crack developed along the flanged end of the lower crusher shell as indicated, which resulted in a portion of the flange being shorn off entirely. The vibration caused by disalignment made crushing difficult. As no spare lower shell was available and repair by welding methods was out of the question, the problem was successfully solved in the following manner. First, a steel ring, somewhat larger in diameter than that of the lower shell and hopper flange sections, was prepared at the blacksmith shop. The lower shell and hopper parts

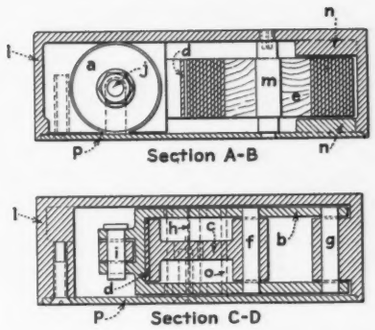




A Safety Shockbreaker

UP TO THE PRESENT only imperfect means exist to secure workmen on scaffoldings or other places where they run the risk of falling off. The only way to attain security is to attach them to an unmovable point. Inasmuch, however, as the indispensable room for movement must be left, a fall from a height of 6½ ft. (6 m.) will always remain possible. The problem involved in designing any device that will provide safety is to destroy the energy produced by the fall in such a way that the retarding force will not be more intense than the falling person can stand. The average weight of a workman may be taken at 165 lb.

J. W. Scherrer writes that the Inspection of Mines in Holland has recently designed the device shown in the accompanying cut, to meet the purpose. The steel strip *d* to which the workman is fastened is rolled up in the interior of the box *k* on a spindle *e*, which can be turned from the exterior. Before leaving the box, the steel strip runs between the parts *b* and *c* of the retarding (brake) mechanism, which will open when *c* is moved upwards, turning at *f*. In case the steel strip is wound off (which will always happen, when a person, who is fastened to it, falls) part *c* will move downward. The situation of the spindle *f* causes the side of *c*, in contact with *d*, to move towards the opposite side of part *b*; thus *d* is gripped between the parts *b* and *c* of the brake mechanism, and



in proportion to the intensity of the grip as *d* unrolls, the friction energy will increase. If part *b* were unmovably fastened in *i*, by the situation of the spindle, *f*, the steel strip *d* would be gripped tightly between the parts *b* and *c* and consequently the strip would snap in case of a normal height of fall of the fastened person.

This cannot happen with the construction described; for with the increase of the grip intensity, the power with which the strip pulls down the parts *b* and *c* increases and, as *b* turns *g*, the steel spring *a* will be pressed down by bolt *j*. In this manner the entire retarding mechanism will move downward, while the friction increases; as soon as the latter has attained the necessary degree, *c* is stopped by *h*. Now the strip will move downward, while the braking mechanism does not move. In this way, during the motion of the strip, the falling energy is gradually annihilated and the falling person will not be subject to a damaging shock, if the degree of the friction is well chosen.

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A Novel Shaft-Sinking Job

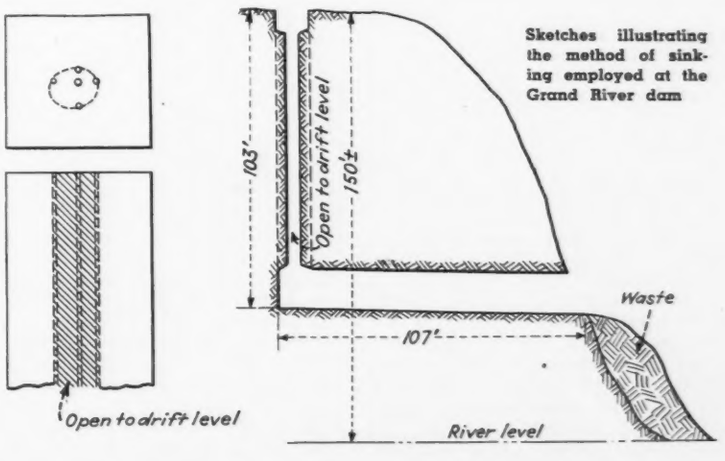
NOTEWORTHY among the major construction jobs in northeastern Oklahoma is the Grand River dam project near Langley. A part of the development required the sinking of a 103 ft. shaft, 11x12 ft. in the clear and connecting with a 107-ft. tunnel, 14x16 ft. in the clear, as shown on the accompanying sketch. by William F. Netzeband, of Joplin, Mo. The shaft and tunnel are to be used for the installation of machinery in the dam power house, which will be constructed at the tunnel entrance.

First plans called for a conventional shaft-sinking job and then driving the tunnel out to the edge of the bluff. Plans were later changed to driving the tunnel from the edge of the bluff under the shaft site and then raising on the shaft. To facilitate drilling, an 8-in. churn-drill hole was drilled in the center of the proposed shaft to the tunnel level. A cable was to be strung through this hole and the driller's platform raised and lowered from a hoist on the surface. Because the rock is an unfractured, interbedded limestone and chert, it was possible to drill the hole perfectly true to the perpendicular.

As an experiment, a 6-in. churn drill hole was put down 12 in. from the first and both were shot the entire depth of the shaft. It was found that both holes broke clean and left a core of shattered rock between. Based on the experiment just mentioned, three other holes were drilled, one 18 in. and two 24 in. from the center hole as shown. These four holes were then shot for the full depth of the shaft, and a core of broken rock about 4 ft. in diameter was formed.

In the meantime the tunnel had been completed to the shaft site and the broken rock from the core was removed at the tunnel level. This left a shaft roughly 4 ft. in diameter from the surface to the tunnel level, and it was a simple matter to square up the shaft to required size with jackhammers. Most of the broken rock would fall to the tunnel level, and it was necessary to muck by hand only enough to drill the next round.

All mucking was done with a scraper-loader, and the waste rock spilled into the river bed about 30 ft. below the tunnel entrance.



Sketches illustrating the method of sinking employed at the Grand River dam

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of the crusher then were carefully aligned, and all bolts tightened. Finally, the steel ring resting on wooden block at proper height was centered, and the space between ring and the flange filled with molten zinc after the bottom of the void had been sealed with clay. The crusher has been in operation for many months without showing the least sign of weakness. The item was submitted by G. E. Jarpe, mill superintendent.

NEW BOOKS

MANUAL OF SEDIMENTARY PETROGRAPHY. *By W. C. Krumbein and F. J. Pettijohn. Published by D. Appleton-Century Company, New York. Pp. 549. Price $6.50.*

AS THE FIRST BOOK to cover in thorough manner the entire field of sedimentary petrography, this volume will be welcome to those studying sedimentary rocks. It compiles a great deal of data formerly scattered through literature in a large number of short articles, and adds considerable new information.

The volume is divided into two approximately equal parts. The first, by Krumbein, deals with sampling, preparation of sediments for analysis, and with methods of analysis. It includes a chapter on statistics and another on graphical presentation. These two chapters alone justify the entire volume. Being mathematical, they are not easy reading for the average geologist. The principles involved are not only applicable to the study of sediments, but could be used in analyzing any sort of scientific data, and no doubt will be of as much value to the igneous-rock petrologist and the mining engineer as to the student of sediments.

The final chapter of the first part discusses orientation analysis of sedimentary particles.

Part II, by Pettijohn, is concerned with shape analysis, mineralogical and chemical analysis, and mass properties of sediments. It begins with a discussion of shape and roundness and continues with a consideration of surface textures of grains. The next three chapters, dealing with preparation of the sample (disaggregation and clarification of grains), separation methods, and mounting for microscopic study, form the most valuable portion of Part II. A very thorough discussion is given of the apparatus, materials, and techniques used.

The chapters dealing with optics and description of minerals are brief and will not replace the standard references; but they are intended to serve merely as summaries. Each mineral description is illustrated by a drawing of several grains as they appear in sediments. These are well done and indicate many of the distinctive properties. Useful tables of the detrital minerals are given. Table 45, however, which groups the minerals according to their source, could well be expanded to include more than five sources; and it contains, in the reviewer's opinion, a number of errors.

The concluding chapters deal with mineral frequencies—a discussion of thin-section analysis will be of particular interest to igneous rock petrologists; chemical methods of study such as microchemical tests, staining, insoluble residues, and determination of organic content; mass properties such as color, specific gravity, porosity, permeability, and plasticity; and finally a few pages on the arrangement of a laboratory and a list of apparatus and references.

This book may be considered a significant milestone in the forward progress of the study of sediments, for it is the first comprehensive work to place such a study on a systematic quantitative basis. As such, it should be hailed as opening a broad and fruitful field of investigation to students of sedimentary rocks and as a means by which the geologist may clear up problems hitherto not possible to solve. In spite of this, however, the reviewer cannot look upon this advance in technique with complete composure and satisfaction. In opening such a field of exact measurement there is always the danger that many will measure for measurement's sake or some will feel called upon to outdo each other in the making of measurements in a manner quite out of proportion, from the point of view of time and energy required, to the conclusions at which they may expect to arrive. There will be those who will feel that the description of any sedimentary rock necessitates histograms, logarithmic curves, and a page or two of mathematics; or that the description of any igneous or metamorphic rock is not complete without its petrofabric diagram. The above is in no sense a criticism of the book under discussion, but rather a warning to its readers. The reviewer does not intend to speak disparagingly of the techniques of exact measurement on the rocks mentioned, but on the contrary regards them with much favor. They should, however, be used with discretion and with a clear idea of the objective to be attained; and should not be used where simpler, more direct, and more rapid field and laboratory methods are adequate to solve the problem at hand.

H. H. HESS

ENGINEERING TERMINOLOGY. Second edition. *By Victor J. Brown and Delmar G. Runner. Published by Gillette Publishing Company, 330 South Wells St., Chicago, Ill. Pp. 439. Price $4.*

THE AUTHORS offer this book to fill a need in engineering literature—that of defining the accepted meaning of a word or phrase as used in a particular branch of engineering. The fields that are covered in comprehensive manner are highway, streets, waterworks, sewerage, structure, architecture, air conditioning, engineering economics, and railway. Some words commonly used in general geology are listed, but the nomenclature of the metal-mining industry is, to a mining engineer, conspicuous by its absence. He fails to find common words in his field that he is asked many times to explain, such as hanging wall, footwall, crosscut, raise, winze, and salting, missing. These words and many other mining terms in Bulletin 95, Bureau of Mines, which the authors list as among their references, should be selected and placed in the next edition so as to include a representative collection of mining terms. The authors frankly admit, however, in their preface to the second edition, that the book is not complete and they expect to enlarge and revise. English-Spanish, Spanish-English, and German-English technical words, together with many other useful appendices, aid in making the book useful.

H. C. CHELLSON

MINING HANDBOOK OF AUSTRALIA, 1939. *Second Edition. Tait Publishing Company, 349 Collins St., Melbourne, Australia. Pp. 436. Price 20s. plus 1d. postage.*

THIS EDITION, following the first by three years, contains data on many companies not mentioned in the earlier book because they were not then in existence. More than 600 mining companies are covered, with the inclusion of numerous maps, a new feature. More space is given to technical matters than before. The book will be found convenient as a reference on the mining and oil industry in Australia, New Zealand, New Guinea, and Papua.

ARC WELDING IN DESIGN, MANUFACTURE, AND CONSTRUCTION. *The James F. Lincoln Arc Welding Foundation, Cleveland, Ohio. Pp. 1408. Price $1.50 in United States; $2 elsewhere.*

DEDICATED to scientific progress of arc welding, this volume comprises 109 outstanding papers awarded prizes in the James F. Lincoln Foundation Award in 1938. The book, therefore, is a voluminous contribution to the welding industry by engineers, designers, architects, draftsmen, and production officials, who describe the benefits obtained through welding based on their work and studies. Eleven industrial fields are covered: automobile, aircraft, railroad, water craft, structural, furniture and fixtures, commercial welding, containers, welderies, functional, and industrial machinery. Data are given on welding costs in these industries and the last two mentioned contain descriptions of welding operations common to the mining industry, such as elevators, conveyors, hoisting equipment, pumps, and general plant equipment.

PROTECTIVE COATINGS FOR METALS. *By R. M. Burns and A. E. Schuh. American Chemical Society Monograph Series. Reinhold Publishing Corporation 330 West 42 St., New York, N. Y. Pp. 407. Price $6.50.*

"THE ADVANCES which have been made in the metal coating industry during the past decade have been so numerous and important that one is inclined to speak in superlatives in referring to them." This is the first sentence by H. S. Rawdon, of the National Bureau of Standards, in his foreword written in the book. The 16 chapters of this volume describe these advances in comprehensive manner, and are of special interest for those

who have problems of protection against corrosion. It is not intended to be a manual for the production of protective coatings although considerable information is given on this phase of the subject. Coatings of zinc, cadmium, tin, nickel, chromium, copper, lead, aluminum and the noble and rare metals and miscellaneous metals, written by R. M. Burns, are discussed and explained in interesting detail. Three chapters written by A. E. Schuh are devoted to the composition, durability and evaluation of paints and paint practices. The book is a valuable monograph for readers seeking pertinent technical information to combat corrosion of metals by employing protective coatings.

HANDBOOK OF INDUSTRIAL FABRICS. *By George B. Haven, S.B. In charge of Textile Research, Massachusetts Institute of Technology, Cambridge, Mass. Second edition. Wellington Sears Company, 65 Worth St., New York, N. Y. Size 5½ in. wide by 8 in. Pp. 741. Price $2.*

A GENERAL HANDBOOK for engineers, purchasing agents, and salesmen that has data for the mine or mill plant manager on fabrics used for conveyors, bagging, drying, insulation and filtering, and other minor industrial uses common to mining and metallurgy

STRUCTURAL ALUMINUM HANDBOOK. *Aluminum Company of America, Pittsburgh, Pa. Size 5¾ in. wide by 8½ in. Pp. 211. Price $1.25.*

A HANDBOOK that presents, for the first time, fundamental information regarding the ultimate strength of structural members fabricated from aluminum alloys. Data are presented by means of discussion, examples, and tables based on laboratory investigation, field tests, and extensive practical experience.

PRACTICAL OIL GEOLOGY. Fifth Edition. *By Dorsey Hager. McGraw-Hill Book Co. Pp. 466. Price $4.*

THIS EDITION has been expanded to cover developments occurring since the fourth edition appeared twelve years ago. The new material includes a chapter on geophysics, one on paleontology, and miscellaneous other additions. The book is handy in size despite its 466 pages.

DIESEL ENGINES. THEORY AND DESIGN. *By H. E. Degler. Published by American Technical Society, Drexel Ave. at 58th St., Chicago. Pp. 270. Price $2.50.*

ALTHOUGH their widespread adoption in the mining industry lagged long after the real opportunity for them became apparent, diesel engines are now so frequently found in mine plants that their presence no longer excites comment. The diesel has indeed arrived and is especially serviceable in remotely situated camps. According to the publishers, this book has been written primarily for students, designers and draftsmen. The scope and nature of the treatment of the subject are indicated by the five major headings under which it is dealt with. These are: Thermodynamics of internal-combustion cycles; fuels, combustion, and combustion chambers; testing and performance; principles of engine design; and, design of major engine parts.

MINING DIRECTORY OF MINNESOTA 1939. *By John J. Craig. University of Minnesota Mines Experiment Station, Minneapolis, Minn. Pp. 240.*

THIS is the twentieth edition of the Mining Directory. It consists of five parts: 1, Maps showing the name and location of mines and reserve properties and other useful information. 2, A list of all mines or properties that have shipped ore or are listed on the tax records as having ore. 3, A list of the mining companies and holding organizations identified with the Minnesota iron ranges, with a list of officials, subsidiaries, and properties in which they are interested. 4, Iron mining statistics. 5, A partial list of men associated with the State's mining industry.

SURVEY OF MINES 1938-9. *Canada and Newfoundland. Financial Post, Maclean Publishing Company, Ltd., Montreal. Pp. 316, plus 32 pages of maps. Price $2.*

ONE of the most complete lists of mines in Canada and Newfoundland. Its contents comprise a tabulation of the price range of Canadian mining stocks, tables of Canadian mineral production, a tabulation of the names and addresses and officials of the principal mines and mills in Canada, dividends paid by metal mines, and the price range of metals. The main body of the book has eleven chapters, each constituting a review of the mining companies and their production statistics in the respective provinces and territories of the Dominion, and Newfoundland. The companies in each chapter are arranged alphabetically, the whole being preceded by an alphabetical index of the companies in Canada and Newfoundland without respect to provinces or territories.

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PUBLICATIONS

RECEIVED

Some Memories of a Palaeontologist. By William Berryman Scott, Princeton University Press, Princeton, N.J. Pp. 336. Price $3.

Science and Social Change. Compiled by Jesse F. Thornton. The Brookings Institution, Washington, D.C. Pp. 570. Price $3.

The Iron and Steel Industries of Europe. By Charles Will Wright, U.S. Bureau of Mines Economic Paper 19. For sale by Superintendent of Documents, Washington, D.C. Price 20c. Pp. 98.

Year Book of the Engineering Profession in British Columbia, 1939. Published by the Association of Professional Engineers of the Province of British Columbia, 718 Granville St., Vancouver, B.C. Pp. 132.

Silver Research. Ninth Progress Report, American Silver Producers' Research Project, July 1, 1939. Contains supplementary reports submitted by research fellows.

Mining in Kenya. A pamphlet of information issued by the Commissioner of Mines, Mining, and Geological Department, Box 339, Nairobi, Kenya Colony, East Africa. Pp. 27, plus 2 maps.

Annotated Bibliography of Economic Geology. General Index, Vols. 1-X, 1928–1938. Published by Economic Geology Publishing Company, Urbana, Ill. Pp. 496. Price $5.

Transactions, 1938, of Canadian Institute of Mining and Metallurgy and of the Mining Society of Nova Scotia. Published at the Institute's office, 906 Drummond Bldg., Montreal, Que. Pp. 524.

Das chemische Feuerlöschwesen. (Chemical fire-extinguishing). By Dr. Oskar Kausch. Published by Verlag von S. Hirzel, Königstrasse 2, Leipzig, Cl, Germany.

Alloy Cast Irons. Published by the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill. Pp. 270. Price $3.

Accounting for Non-ferrous Metal Mining Properties and Their Depletion. By Henry B. Fernald, M. E. Peloubet, and L. M. Norton. Pp. 12, an article in the August, 1939, issue of "The Journal of Accountancy." American Institute Publishing Co., 13 East 41st St., New York, N. Y.

Wood Structural Design Data. Vol. I. Second Edition. National Lumber Manufacturers Association, Washington, D.C. Price $1, or, with five supplements containing additional technical information useful in wood design, $1.25.

Australasian Institute of Mining and Metallurgy Proceedings. Pamphlets 110, 111, 112, and 113, New Series, 1938–39.

Handbook of Mica. By R. R. Chowdhury. Thacker, Spink & Co., Box 54, Calcutta, India. Pp. 344. Price 22s.6d.

Capital Goods and the American Enterprise System. A statement of economic and social principles underlying the numerous interrelationships of the capital goods industries and the American enterprise system. Published by Machinery and Allied Products Institute, 221 North LaSalle St., Chicago, Ill. Pp. 86.

Virginia Geological Survey, at University, Va., has issued Bulletin 49, County Series No. 2, entitled "Outline of the Geology and Mineral Resources of Russell County, Virginia," by H. P. Woodward; pp. 91 plus map. Also Bulletin 50, "Ground-water Resources of Northern Virginia," by R. C. Cady; pp. 200. Also Bulletin 53, "Barite Deposits of Virginia," by R. S. Edmundson; pp. 85.

Tin Statistical Year Book of the International Tin Research and Development Council, Fraser Road, Greenford, Middlesex, England. Compiled by the Council's office at the Hague. It gives the tin output of all producing areas since 1800 and presents statistics on all industries consuming tin. Size, 10½x8 in. Pp. 200. Price 8s, post free.

Philippine Bureau of Mines, at Manila, P. I., has issued Information Circular No. 1. "Placer Operations of North Mindanao Mining Company, Surigao, Mindanao," by W. F. Boericke and N. M. Lim; pp. 20; also Information Circular No. 2, "Preliminary Report on Manganese Ore Beneficiation at Grawfus Mining Company, Dirique, Ilicos Norte," by W. F. Boericke and N. M. Lim; pp. 12.

"Seven Talks About Mines" issued by the Chamber of Commerce, Butte, Mont. (1) "History of Mining in Montana," by Sam Barker, Jr. (2) "History of Geology and Ore Deposts," by M. H. Gidel. (3) "Mining in the Butte District," by J. J. Carrigan. (4) "Mining in Montana Exclusive of Butte," by Carl J. Trauerman. (5) "Concentration and Smelting of Ores," by C. A. Lemmon. (6) "Refining of Copper and Manufacture of Copper Rods, Wire, and Bare Cable," by E. S. Bardwell. (7) "Production and Uses of Zinc," by H. M. Doran.

Union Miniere du Haut-Katanga. A brochure recently issued to stockholders with the annual report for 1938. Photographs show phases of the company's mining, milling and smelting operations in the Belgian Congo, and brief explanation in French regarding recovery of copper, tin, cobalt, zinc and radium is given. The monograph is comprehensive. Of particular interest are the photographs of well-equipped schools and hospitals and other modern facilities for promoting the welfare of the 12,000 Negro employees. Printed by Imprimerie Industrielle et Financiere, rue du Houblon 47, Brussels, Belgium.

Summary of the

MARKETS

OPTIMISM over business prospects for the fall season ran high in the market for non-ferrous metals until the last week in August, when traders became convinced that a peaceful solution of Europe's difficulties was improbable. A sharp drop in the pound sterling, coupled with the announcement on Aug. 31 that the London Metal Exchange would remain closed on Friday, Sept. 1, crippled normal business relations. Gold in London advanced to 161s. on Aug. 28, a new high.

Consumption of major metals here was higher in August than in July. Copper in the domestic market advanced to 10½c., Valley; lead moved up to 5.05c., New York; and Prime Western zinc was raised to 4.75c., St. Louis. Straits tin sold at 49¾c. late in the afternoon of the last day of August, though our average for the day was somewhat lower. War fears caused buyers to place orders for a good tonnage of tin. Quicksilver, platinum, and iridium prices were higher. Tungsten ore, chrome ore, and manganese ore quotations were more or less nominal as the month ended, owing to higher war risk insurance and uncertainty about shipping.

The *E. & M. J.* index of non-ferrous metal prices for August advanced to 73.88, which compares with 71.95 in July.

Covering by shorts in London resulted in an upward movement in foreign silver prices. Quotations here responded to the advance abroad, even though the Treasury's price remained unchanged.

It was understood that production controls on copper and tin would be lifted in the event of a general conflict. A tight market for near-by copper abroad caused the Cartel to raise production to 105 per cent of the basic tonnages, effective Aug. 16.

The zinc industry is interested in the outcome of a hearing on the zinc tariff scheduled for Sept. 18 in Washington.

UNITED STATES MARKET

1939 Aug.	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: St. Louis
1	10.150	10.050	48.450	4.95	4.80	4.60
2	10.150	10.125	48.500	4.95	4.80	4.60
3	10.150	10.200	48.650	5.05	4.90	4.60
4	10.275	10.300	48.850	5.05	4.90	4.60
5	10.275	10.300	48.850	5.05	4.90	4.60
7	10.275	10.325	48.800	5.05	4.90	4.60@4.75
8	10.275	10.325	48.700	5.05	4.90	4.75
9	10.275	10.275	48.700	5.05	4.90	4.75
10	10.275	10.200	48.725	5.05	4.90	4.75
11	10.275	10.200	48.700	5.05	4.90	4.75
12	10.275	10.175	48.700	5.05	4.90	4.75
14	10.275	10.200	48.750	5.05	4.90	4.75
15	10.275	10.200	48.750	5.05	4.90	4.75
16	10.275	10.175	48.750	5.05	4.90	4.75
17	10.275	10.125	48.750	5.05	4.90	4.75
18	10.275	10.225	48.825	5.05	4.90	4.75
19	10.275	10.275	48.800	5.05	4.90	4.75
21	10.275	10.225	48.700	5.05	4.90	4.75
22	10.275	10.225	48.700	5.05	4.90	4.75
23	10.275	10.200	49.000	5.05	4.90	4.75
24	10.275	10.150	49.500	5.05	4.90	4.75
25	10.275	10.150	48.875	5.05	4.90	4.75
26	10.275	10.125	49.000	5.05	4.90	4.75
28	10.275	10.150	48.125	5.05	4.90	4.75
29	10.275	10.250	49.125	5.05	4.90	4.75
30	10.275	10.300	48.875	5.05	4.90	4.75
31	10.275	10.250	49.250	5.05	4.90	4.75
			AVERAGES FOR MONTH			
	10.261	10.211	48.793	5.043	4.893	4.719
Aug.			AVERAGES FOR WEEK			
2	10.067	10.025	48.458	4.900	4.750	4.600
9	10.254	10.288	48.758	5.050	4.900	4.663
16	10.275	10.192	48.729	5.050	4.900	4.750
23	10.275	10.213	48.796	5.050	4.900	4.750
30	10.275	10.188	48.917	5.050	4.900	4.750
Aug.			CALENDAR WEEK AVERAGES			
5	10.171	10.167	48.625	5.000	4.850	4.600
12	10.275	10.250	48.721	5.050	4.900	4.738
19	10.275	10.200	48.771	5.050	4.900	4.750
26	10.275	10.179	48.963	5.050	4.900	4.750

SILVER, GOLD, AND STERLING EXCHANGE

NEW YORK AND LONDON

1939 Aug.	Sterling Exchange: "Checks"	Sterling Exchange: "90-day demand"	Silver: (c) New York	Silver: London	Gold: London	Gold: (d) United States
1	4.680000	4.662500	34.750	16.8125	148s 6½d	$35.00
2	4.680000	4.662500	34.750	16.6875	148s 6½d	35.00
3	4.678750	4.661250	34.750	16.6250	148s 6½d	35.00
4	4.678750	4.661250	34.750	16.6875	148s 6½d	35.00
5	(e)	(e)	(e)	16.8125	148s 6½d	35.00
7	4.680000	4.661250	34.750	Holiday	Holiday	35.00
8	4.680000	4.660625	34.750	16.8750	148s 6½d	35.00
9	4.678750	4.657500	34.750	16.8750	148s 6d	35.00
10	4.678750	4.656250	35.125	17.0000	148s 6½d	35.00
11	4.678750	4.656250	35.250	17.0625	148s 6½d	35.00
12	(e)	(e)	(e)	17.1250	148s 6½d	35.00
14	4.678750	4.657500	35.625	17.1875	148s 7½d	35.00
15	4.678750	4.658750	35.750	17.3125	148s 7d	35.00
16	4.679375	4.660625	35.250	17.0625	148s 7d	35.00
17	4.678750	4.655000	35.250	17.0000	148s 7d	35.00
18	4.678750	4.655000	35.375	17.0625	148s 7d	35.00
19	(e)	(e)	(e)	17.1250	148s 7d	35.00
21	4.677500	4.652500	36.500	17.5625	148s 7d	35.00
22	4.677500	4.651250	37.750	18.4375	148s 6½d	35.00
23	4.677500	4.651250	37.250	18.0625	148s 6½d	35.00
24	4.672500	4.632500	39.625	19.0625	148s 5d	35.00
25	4.380000	(f)	39.750	20.0625	150s 6d	35.00
26	(e)	(e)	(e)	20.0625	155s	35.00
28	4.270000	4.235000	36.125	19.1250	161s	35.00
29	4.355000	4.325000	37.000	19.5000	157s	35.00
30	4.400000	4.366250	36.500	19.0625	158s 6d	35.00
31	4.270000	4.240000	35.500	18.4375	159s	35.00
			AVERAGE FOR MONTH			
	4.60383	.....	35.951	17.719	.....	35.00
Aug.			AVERAGES FOR WEEK			
2	4.680000	.....	34.750	.....	.....	.....
9	4.679250	.....	34.750	.....	.....	.....
16	4.67888	.....	35.400	.....	.....	.....
23	4.67800	.....	36.425	.....	.....	.....
30	4.41550	.....	37.800	.....	.....	.....

Calendar week averages: New York Silver 5th, 34.750; 12th, 34.925; 19th, 35.450; 26th, 38.175.

(e) Not quoted (Saturday).

(f) No quotation.

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

(b) Export prices are net at refineries on the Atlantic seaboard and include sales of domestic copper in the foreign market. Most sales in the foreign market are made on the basis of c.i.f. usual ports of destination—Hamburg, Havre, and Liverpool. The c.i.f. basis commands a premium of 0.325c. per pound above our refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c. per troy ounce. Handy & Harman's quotation on newly-mined domestic silver, 999 fine, was 70⅝c throughout August.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which at present is equal to $34.9125.

PRICES OF METALS • MISCELLANEOUS QUOTATIONS

LONDON MARKET

1939	COPPER			TIN		LEAD				ZINC			
	Standard		Electro	Standard		Spot		3 months		Spot		3 months	
Aug.	Spot	3 months	Bid	Spot	3 months	Buyers	Sellers	Buyers	Sellers	Buyers	Sellers	Buyers	Sellers
1	43.7500	43.9375	49.2500	229.8750	225.1250	15.2500	15.3125	15.2500	15.3125	14.5625	14.6250	14.7500	14.8125
2	44.0000	44.2500	49.5000	229.8750	225.0000	15.4375	15.5000	15.3750	15.5000	14.5000	14.5625	14.6875	14.8125
3	44.6250	44.7500	50.0000	229.8750	225.2500	15.6875	15.7500	15.5625	15.6250	14.5000	14.5625	14.6875	14.8125
4	44.6875	44.8750	50.2500	229.8750	225.5000	16.0625	16.1875	16.0000	16.0625	14.5000	14.5625	14.7500	14.8125
7	Holiday												
8	44.7500	44.8750	50.2500	229.8750	225.5000	16.1875	16.2500	16.1250	16.1875	14.5625	14.6250	14.8125	14.8750
9	44.6250	44.7500	50.2500	229.8750	225.5000	16.0625	16.1250	15.9375	16.0000	14.4375	14.5000	14.6875	14.7500
10	44.2500	44.3750	49.7500	229.8750	225.2500	15.9375	16.0000	15.7500	15.8125	14.3750	14.5000	14.6250	14.6875
11	44.1250	44.1250	49.5000	229.8750	225.2500	15.8750	16.0000	15.6250	15.7500	14.3125	14.4375	14.5000	14.5625
14	44.3750	44.3750	49.7500	229.8750	225.2500	15.8125	15.8750	15.6250	15.6875	14.4375	14.5000	14.6250	14.6875
15	44.3750	44.4375	50.2500	229.8750	225.0000	15.7500	15.8125	15.5625	15.6250	14.5000	14.6250	14.6250	14.6875
16	44.3125	44.3750	50.2500	229.8750	225.2500	15.7500	15.8125	15.6250	15.6875	14.4375	14.5000	14.6250	14.6875
17	44.0000	44.1250	50.0000	229.8750	225.0000	15.8125	15.8750	15.6875	15.7500	14.3750	14.5000	14.5625	14.6875
18	44.9375	45.0000	50.0000	229.8750	225.3750	15.9375	16.0000	15.8125	15.8750	14.4375	14.5625	14.6250	14.6875
21	45.0000	45.0625	50.7500	229.8750	224.7500	16.1875	16.2500	16.0000	16.0625	14.3750	14.5000	14.5625	14.6875
22	44.9375	44.8125	50.2500	229.8750	224.2500	16.0000	16.0625	15.8125	15.8750	14.3750	14.5000	14.5000	14.5625
23	44.6250	44.3750	50.2500	229.7500	223.5000	16.1250	16.1875	15.8750	16.0000	14.3750	14.5000	14.5000	14.5625
24	44.0000	44.1250	49.2500	229.8750	222.8750	15.8750	15.9375	15.7500	15.8125	14.4375	14.5625	14.5625	14.6875
25	45.3750	45.4375	50.5000	229.8750	224.6250	16.2500	16.3125	16.0625	16.1250	14.8125	14.8750	14.8750	14.9375
28	45.8125	46.1250	52.5000	229.8750	226.1250	16.6250	16.7500	16.4375	16.5000	15.2500	15.3125	15.1250	15.1875
29	46.2500	46.3750	52.5000	229.8750	226.5000	16.3750	16.5000	16.1875	16.2500	15.1250	15.2500	15.1875	15.2500
30	45.5000	45.8125	52.0000	229.8750	226.7500	16.5000	16.6250	16.3750	16.4375	15.0000	15.1250	15.0000	15.0625
31	44.7500	45.1250	52.0000	229.8750	226.5000	16.5000	16.6250	16.2500	16.3125	15.0625	15.1875	15.0000	15.1250
Average for month	44.685	.....	50.409	229.869	.....	16.040		15.885		14.628		14.761	

Prices for lead and zinc are the official prices for the first session of the London Metal Exchange; prices for copper and tin are the official closing buyers prices. All are in pounds sterling per long ton of 2,240 lb

CURRENT PRICES — MISCELLANEOUS METALS, ORES, AND NON-METALLIC MINERALS

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

(Sept. 1, 1939)

MISCELLANEOUS METALS

Aluminum, ingot, 99 plus per cent, lb	20c.
Antimony, domestic, spot, lb	12.00c.
Bismuth, ton lots, lb	$1.10
Cadmium, commercial sticks, lb	55c.
Calcium, lb., ton lots 97 @ 98 per cent	75c.
Chromium, 97 per cent grade, lb	85c.
Nickel, electrolytic cathodes, lb	35c.
Magnesium, 99.8 per cent, carolads, lb	27c.
Palladium, troy oz	$24.00
Platinum, (Official quotation) troy oz	$38.00
Quicksilver, flask of 76 lb., 100 flasks or more	$90.00@$92.00
Radium, mg. radium content	$25.00@$30.00
Selenium, 99.5 per cent, lb	$1.75
Silicon, minimum 97 per cent, spot, lb	16.50c.
Tellurium, lb	$1.75
Thallium, 100 lb. or more, lb	$6.50
Titanium, 96 to 98 per cent, lb	$5.00

METALLIC ORES

Beryllium Ore, f.o.b. mines, ton	$30.00@$35.00
Chrome Ore, 48 @ 50% Cr_2O_3 c.i.f. Atl. ports, long ton	$18.00@$19.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.25
Mesabi bessemer	$5.10
Old Range non-bessemer	$5.10
Mesabi, non-bessemer	$4.95
Lead (Galena) 80 per cent, Joplin, Mo., ton	$55.50@$60.50
Manganese Ore, c.i.f. Atlantic ports, long ton unit of Mn:	
52 @ 55 per cent	29c.
50 @ 52 per cent	28c.
44 @ 48 per cent	24c.
Molybdenum Ore, 90 per cent, per lb. of contained MoS_2	45c.
Tungsten Ore, per unit of WO_3:	
Chinese, 65 per cent, duty paid	$18.00
Domestic, 65 per cent and upward	(a)$16.00@$18.00
Vanadium Ore, per lb. of contained V_2O_5	27½c.
Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton	$31.50

(a) Prices at mines, small lots, usually several dollars less.

METALLIC COMPOUNDS

Arsenious Oxide (arsenic) lb	3c
Cobalt Oxide, 70 @ 71 per cent, lb	$1.67@$1.77
Copper Sulphate, 100 lb	$4.25
Sodium Nitrate, ex vessel, in 200-lb. bags, per 100 lb	$1.42
Sodium Sulphate, bulk ton	$13.00@$15.00

ALLOYS

Berrylium Copper, master alloy, 2.5 to 3 per cent Be, per lb. of contained Be	$15.00
Ferrochrome, 65 @ 70 per cent chromium, 4 @ 6 per cent carbon, lb	10½c.
Ferromanganese, 78 @ 82 per cent, gross ton	$80.00
Ferromolybdenum, 55 @ 65 per cent Mo. lb. of Mo. contained	95c.
Ferrosilicon, 50 per cent, gross ton	$69.50
Ferrotungsten, 75 @ 80 per cent, lb. of W contained	$1.50

NON-METALLIC MINERALS

Asbestos, f.o.b. mines, ton:	
Canadian (Quebec)	
Crude No. 1	$700@$750
Crude No. 2	$150@$350
Spinning fibers	$110@$200
Paper stock	$40@$45
Shorts	$12@$16 50
Vermont	
Shingle stock	$57
Paper stock	$40
Cement stock	$25
Barytes, long ton:	
Georgia, crude	$7.00
Missouri, 90 per cent $BaSO_4$, less than 1 per cent iron	$6.00@$7.00
Bauxite, long ton:	
Domestic, chemical, 55 @ 58 per cent	$6.00@$7.00
Domestic, abrasive, 80 @ 84 per cent	$12.00@$14.00
Dalmatian, 50 @ 55 per cent	(a)$6.00@$7.00
French, 56 @ 59 per cent	(a)$7.00@$8.00
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, bulk	$6.75@$8.00
Delaware, No. 1	$14.50
Feldspar, bulk, ton:	
Potash feldspar, 200 mesh	$17.00
Glass-spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 85–5 per cent, all rail movement, ton	$18.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton:	
Dead-burned, f.o.b. California	$25.00
Dead-burned, f.o.b. Washington	$22.00
Mica, per lb., North Carolina, No. 1 and 2 quality:	
1½ x 2 in	25@30c.
2 x 2 in	40@50c.
3 x 3 in	$1.00@$1.20
3 x 4 in	$1.30@$1.40
3 x 5 in	$1.50@$1.70
White, ground, 70 mesh, ton	$60.00@$80.00
Ocher, Georgia, ton	$19.00@$22.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12c.
Silica, in bags, 325 mesh, ton	$18.00@$40.00
Sulphur, Texas mines, long ton	$16.00
Talc, f.o.b. works, ton:	
New York, double air-floated, 325 mesh	$12.00@$15.00
New Jersey, mineral pulp	$8.00@$10.00
Vermont, extra white, 200 mesh	$9.00@ $9.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50
200 mesh, cream colored	$26.00

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton:	
Bessemer	$21.50
Basic	$20.50
No. 2 Foundry	$21.00
Steel, base prices, Pittsburgh:	
Billets, gross ton	$34.00
Structural shapes, 100 lb	$2.10
Bars, 100 lb	$2.15

Monthly and Yearly

AVERAGE PRICES

SILVER AND STERLING EXCHANGE

	New York		London Spot		Sterling Exchange	
	1938	1939	1938	1939	1938	1939
January	44.750	42.750	19.895	20.305	499.895	466.775
February	44.750	42.750	20.159	20.370	501.722	468.472
March	44.446	42.750	20.088	20.280	498.394	468.370
April	42.750	42.750	18.880	20.031	498.046	467.778
May	42.750	42.750	18.731	20.123	496.673	467.988
June	42.750	41.955	18.945	19.505	495.772	468.137
July	42.750	34.944	19.356	16.952	492.855	468.031
August	42.750	35.951	19.389	17.719	488.044	460.383
September	42.750	.....	19.300	.....	480.210	.....
October	42.750	.....	19.613	.....	476.785	.....
November	42.750	.....	19.834	.....	470.587	.....
December	42.750	.....	20.083	.....	466.798	.....
Year	43.225	.....	19.523	.....	488.818	.....

New York quotations for silver other than newly-mined domestic, cents per ounce troy, 999 fine. London, pence per ounce sterling silver 925 fine. Sterling exchange (pound sterling) in cents.

COPPER

	F.O.B. Refinery, Electrolytic				London Spot			
	Domestic		Export		Standard		(a) Electrolytic	
	1938	1939	1938	1939	1938	1939	1938	1939
January	10.198	11.025	9.908	9.912	41.387	43.125	45.387	48.440
February	9.775	11.025	9.525	9.735	39.597	42.188	43.563	47.375
March	9.775	11.025	9.496	9.888	39.772	42.938	43.582	48.120
April	9.775	10.265	9.443	9.820	39.306	42.031	43.408	47.833
May	9.375	9.833	8.801	9.738	36.668	41.656	40.852	47.528
June	8.775	9.775	8.500	9.738	35.235	41.986	39.417	47.528
July	9.585	9.976	9.573	9.944	39.744	42.899	44.405	48.863
August	9.900	10.261	9.844	10.211	40.591	44.685	45.909	50.409
September	10.028	.....	9.943	.....	41.864	.....	47.148	.....
October	10.760	.....	10.713	.....	45.646	.....	51.190	.....
November	11.025	.....	10.569	.....	45.244	.....	51.080	.....
December	11.025	.....	10.023	.....	43.428	.....	48.988	.....
Year	10.000	.....	9.695	.....	40.707	.....	45.411	.....

New York quotations, cents per pound. London, pounds sterling per long ton, (a) Bid quotation.

LEAD

	New York		St. Louis		London			
	1938	1939	1938	1939	1938 Spot	1938 3 mos.	1939 Spot	1939 3 mos.
January	4.870	4.826	4.720	4.676	16.135	16.253	14.534	14.744
February	4.632	4.805	4.482	4.655	15.402	15.525	14.283	14.417
March	4.500	4.824	4.350	4.674	15.992	16.075	14.660	14.860
April	4.500	4.782	4.350	4.632	15.579	15.623	14.337	14.533
May	4.400	4.750	4.250	4.600	14.210	14.376	14.483	14.679
June	4.148	4.800	3.998	4.650	13.969	14.012	14.564	14.651
July	4.882	4.854	4.732	4.704	14.924	15.034	14.753	14.856
August	4.900	5.043	4.750	4.893	14.371	14.480	16.040	15.885
September	4.998	...	4.848	.....	15.249	15.401	.....	.....
October	5.100	.....	4.950	.....	16.173	16.313	.....	.....
November	5.091	.....	4.941	.....	16.088	16.223	.....	.....
December	4.842	.....	4.692	.....	15.106	15.275	.....	.....
Year	4.739	...	4.589	.....	15.266	15.383	.....	.....

New York and St. Louis quotations, cents per pound. London pounds sterling per long ton.

TIN

	Straits New York		Standard, Spot London	
	1938	1939	1938	1939
January	41.548	46.404	183.619	215.435
February	41.373	45.640	183.144	213.906
March	41.219	46.213	183.473	215.375
April	38.430	47.160	168.612	218.389
May	36.885	49.031	162.693	225.591
June	40.376	48.853	177.429	227.511
July	43.428	48.548	192.542	229.833
August	43.276	48.793	192.966	229.869
September	43.369	.....	193.733	.....
October	45.263	.....	206.911	.....
November	46.262	.....	213.909	.....
December	46.180	.....	214.450	.....
Year	42.301	.....	189.457	.....

New York quotations cents per pound. London, pounds sterling per long ton.

ZINC

	St. Louis		London			
	1938	1939	1938 Spot	1938 3 mos.	1939 Spot	1939 3 mos.
January	5.000	4.500	14.994	15.173	13.682	13.887
February	4.813	4.500	14.408	14.589	13.522	13.780
March	4.417	4.500	14.364	14.477	13.728	13.961
April	4.141	4.500	13.729	13.919	13.443	13.637
May	4.042	4.500	12.682	12.869	13.717	13.938
June	4.131	4.500	12.890	13.104	14.023	14.223
July	4.745	4.516	14.144	14.371	14.235	14.435
August	4.750	4.719	13.467	13.675	14.628	14.761
September	4.846	.....	14.040	14.246	.....	.....
October	5.012	.....	15.083	15.232	.....	.....
November	4.924	.....	14.366	14.550	.....	.....
December	4.500	.....	13.709	13.861	.....	.....
Year	4.610	.....	13.990	14.172	.....	.....

St. Louis quotations, Prime Western, cents per pound. London, pounds sterling per long ton

CADMIUM AND ALUMINUM

	Cadmium			Aluminum	
	1938 (a)	1939 (a)	1939 (b)	1938	1939
January	117.500	70.900	58.400	20.000	20.000
February	117.500	67.500	55.000	20.000	20.000
March	117.500	65.278	54.259	20.000	20.000
April	102.500	52.500	50.000	20.000	20.000
May	102.500	52.500	50.000	20.000	20.000
June	102.500	52.500	50.000	20.000	20.000
July	102.500	52.500	50.000	20.000	20.000
August	99.722	56.204	53.704	20.000	20.000
September	84.000	.....	.....	20.000	.....
October	80.000	.....	.....	20.000	.....
November	77.717	.....	.....	20.000	.....
December	72.500	.....	.....	20.000	.....
Year	98.037	.....	.....	20.000	.....

Aluminum in cents per pound, 99 plus per cent grade Cadmium, cents per pound; (a) average of producer's end plater's quotations; (b) producers' price, commercial sticks.

ANTIMONY, QUICKSILVER, AND PLATINUM

	Antimony (a) New York		Quicksilver (b) New York		Platinum (c) New York	
	1938	1939	1938	1939	1938	1939
January	13.750	11.670	79.240	77.440	36.000	34.440
February	13.750	11.250	76.455	85.227	36.000	35.000
March	13.750	11.269	72.444	87.278	36.000	35.000
April	13.654	11.500	71.019	90.800	36.000	35.000
May	12.460	11.712	74.640	86.769	33.400	35.000
June	11.731	12.000	80.731	86.615	33.231	35.000
July	11.030	12.000	76.860	86.960	36.000	35.000
August	10.880	12.000	75.500	84.407	37.000	35.333
September	11.310	.....	74.420	.....	39.000	.....
October	12.060	.....	73.480	.....	37.960	.....
November	12.250	.....	74.065	.....	36.217	.....
December	11.567	.....	76.769	.....	34.000	.....
Year	12.349	.....	75.469	.....	35.901	.....

(a) Antimony, cents per pound, ordinary brands, in cases; in bulk deduct .250c. (b) Quicksilver, dollars per flask of 76 lb. (c) Platinum is dollars per ounce troy.

PIG IRON

	Bessemer		Basic		No. 2 Foundry	
	1938	1939	1938	1939	1938	1939
January	24.50	21.50	23.50	20.50	24.00	21.00
February	24.50	21.50	23.50	20.50	24.00	21.00
March	24.50	21.50	23.50	20.50	24.00	21.00
April	24.50	21.50	23.50	20.50	24.00	21.00
May	24.50	21.50	23.50	20.50	24.00	21.00
June	23.73	21.50	22.73	20.50	23.23	21.00
July	20.50	21.50	19.50	20.50	20.00	21.00
August	20.50	21.50	19.50	20.50	20.00	21.00
September	20.50	.....	19.50	.....	20.00	.....
October	21.50	.....	20.50	.....	21.00	.....
November	21.50	.....	20.50	.....	21.00	.....
December	21.50	.....	20.50	.....	21.00	.....
Year	22.686	.....	21.686	.....	22.186	.....

Iron dollars per long ton. F. o. b. Mahoning and Chenango Valley furnaces

PERSONAL ITEMS

Harry J. Wolf was in Springfield, Mass., recently on professional business.

Arthur A. Zentner has changed his name by court action to **Arthur A. Center.**

Dr. J. Slatterly has joined the geological staff of the Ontario Department of Mines.

Jack M. Noy is now employed by Foote Mineral Company as laboratory research chemist.

Charles E. Pryor, former general manager of Wiluna Gold Mines, Ltd., Wiluna, Western Australia, and recently general director, will soon return to Canada.

V. A. Brussolo, formerly at Pachuca, Hidalgo State, Mexico, is now with the North Camarines Gold Mining Company, Paracale, Camarines Norte, P. I.

Charles Hoyle has left the Amparo Mining Company. His home address in Mexico is Escorza No. 77, Guadalajara, Jalisco, Mexico.

Scott Turner, vice-president of International Mining Corporation, has returned from a two weeks' visit to northern Quebec.

J. Dillon has been appointed manager of Milano Gold, N. L., which holds an option on a property at Mount Monger, Western Australia.

O. J. Parker, Jr., general manager of Ora Banda United Mines, Ltd., at Ora Banda, Western Australia, is in London, England.

P. M. Kinney has left the Braden Copper Company, at Rancagua (Sewell), Chile, and may now be addressed at 1502 Third Ave., Scottsbluff, Neb.

R. S. Merriam, mining engineer, of Wallace, Idaho, is directing the development of the Mineral Mountain claims in the silver belt of the Coeur d'Alene district.

Milton T. Dunstan, recently manager of Mount Ida Gold Mines, Ltd., at Mount Ida, W. A., has assumed the management of New Yilgarn Gold Mines, N. L., Nevoria, W. A.

Guy C. Riddell returned to New York from California in late August from the Stenshaw-on-Klamath placer operation on the Klamath River in Siskiyou County.

Hubert D. Kelly has left the staff of Mount Morgan, Queensland, to join the underground staff of Raub Australian Gold Mining Company, Ltd., Raub, Pahang, F. M. S.

Pomeroy C. Merrill, who has been chief consulting engineer for Allied Management Corporation, Manila, P. I., is now in the East Indies. His address is, care of W. G. Vogelpoel, Kalaisin No. 19, Sourabaya, Java.

Louis Ware was on Aug. 18 elected president of the International Agricultural Corporation at the directors' meeting in New York. He succeeds John J. Watson, deceased. International Agricultural Corporation has 25 fertilizer plants in the United States, and is one of the five largest fertilizer producers in

LOUIS WARE

the country. Mr. Ware was born in 1894 and was educated at the college of engineering of the University of Kentucky. After mining in that State and in Arizona, he was in 1926 sent by the Guggenheim interests to install a power-shovel nitrate-mining plant in Chile. From 1930 to 1935 he was with the New York Trust Company and in the last-named year became president of the United Electric Company. He will move from his present residence in Winnetka, Ill., to New York.

K. G. Schwegler, mining engineer, 405 Montgomery St., San Francisco, has returned to his office from a two months' mine inspection trip to British Columbia and southern Alaska.

Dr. Hans Lundberg has announced the opening in New York under the title Hans Lundberg, Inc., of a United States subsidiary company of Hans Lundberg, Ltd., of Toronto.

J. Donald Forrester, recently with the geological department of Anaconda Copper Mining Company, has been made head of the department of geology of the University of Idaho.

A. F. B. Norwood has been appointed consulting metallurgist to Australian Mines Management & Secretariate, Kalgoorlie, W. A., which organization manages the De Bernales group of companies.

Alan M. Bateman, professor of economic geology at Yale University, spent some time this summer at the properties of Utah Copper Company; Nevada Consolidated; Ray Mines, at Ray, Ariz.; and Chino mine, at Santa Rita, N. M.

J. D. McKenzie, manager of the East Helena (Montana) plant of the American Smelting & Refining Company, has been transferred to El Paso, Tex., to take charge of the El Paso and Hayden, Ariz., smelters of the company.

Telesphore Roy, long superintendent of the Vimy mine of the Asbestos Corporation, at Coleraine, Quebec, has retired after more than 50 years' service with the Corporation. He has been succeeded by **C. H. McNaughton.**

Carl J. Nelson, mining engineer, has resigned from Braden Copper Company, Rancagua, Chile, having been appointed mine superintendent of La Luz Mines, Ltd., Siuna, via Puerto Cabezas, Nicaragua, Central America.

W. W. Lynch, formerly general manager of Cia. Minera Unificada del Cerro de Potosi, Bolivia, S. A., has been appointed assistant general manager for the American Potash & Chemical Corporation, Trona, Calif.

L. E. Putnam has joined the staff of Atolia Mining Company, Atolia, Calif., as superintendent, succeeding **D. D. Baker,** who recently resigned. Mr. Putnam managed for several years the Beebe property, at Georgetown, Calif.

W. V. DeCamp, general manager of mines, M. Hochschield S. A. M. I., Oruro, Bolivia, now in the United States on vacation, was recently guest of honor at a dinner of the Mining Association of the Southwest in Los Angeles.

Leo P. J. Gibbons, mine superintendent of Tindals Gold Mines, Ltd., has been appointed chief mining engineer of Australian Mines Management & Secretariate, Ltd., manager of the De Bernales properties. He succeeds **A. E. Faul,** who has retired.

Roger L. Beals, mining engineer, manager of California Engels Mining Company, recently left by Pan American Air Lines for Colombia, South America, to make an examination of several quartz properties in the interest of California Engels.

Jean McCallum, assistant manager of the St. Louis Smelting and Refining Works of the National Lead Company, has been appointed manager of all the Lead company's mining properties. He succeeds the late James A. Caselton. Mr. McCallum has been associated with National Lead since 1918.

Frank Eichelberger, of Wallace, Idaho, has resigned as president and general manager of the Callahan Lead-Zinc Company. He was formerly manager of Sunshine Mining Company at Kellogg, Idaho, which he left in 1936 to join Callahan Lead-Zinc.

Frederick G. Kuehl, who graduated from the Columbia School of Mines in 1930 and who for the past few years has been working in South America, is now employed by the Foote Mineral Company as a construction engineer.

G. S. Brooks, president of Giesche Spolka Akcyjna, Katowice, Poland, reports that the company has been retained as consulting engineers in the design of the new Trepca electrolytic and roasting zinc plants in Yugoslavia.

Frank A. Dunbar, for many years assistant West Coast manager for Taylor-Wharton Iron & Steel Company, representing that company in the California gold-dredging fields, has resigned to accept the position of assistant resident manager of the Yukon Pacific Company. He will be stationed at the company's operations at Kuala Lumpur, F. M. S.

S. G. Turrell, technical representative of the American Cyanamid Company and allied organizations, has been making his usual triennial visit to the United States. He journeyed from Melbourne, Australia, by way of the Far East, visiting the principal mines in the Philippines, Malaya, Netherlands East Indies, and Burma en route.

George Watkin Evans, consulting mining engineer of Seattle, Wash., left that city at the end of August to examine both placer and quartz properties in the Dease Lake region in north-central British Columbia. He accompanies a group of Seattle financiers who are interested in developing properties in that area, and expects to return to Seattle the latter part of September.

John C. Reed, geologist, who has been engaged in Government work in the Chichagof area of Alaska, was seriously hurt by a fall early in July, but his recovery is reported to be probable, as prompt medical aid was assured by bringing a physician into the region by plane. Mr. Reed's injury was the third accident that has befallen any of the Government personnel engaged in work in the territory in forty years of Federal investigations.

▼ ▼ ▼

OBITUARY

John A. Garcia, mining engineer, died in Chicago on Aug. 11. He was 63.

Dr. Wendell C. Mansfield, geologist with the National Museum, died recently in Washington at the age of 65.

Beauregard Ross, a retired Western mining engineer, died on Aug. 8 at Denver, Colo.

Robert Henry Crozier, metallurgist, prominent in Australia and Tasmania mining circles, died recently in West Africa at the age of 54.

John A. Agnew, of London, England, chairman of the board of Consolidated Goldfields, of South Africa, died on Aug. 2 at Trona, Calif., at the age of 67.

Randall P. Sharpe, mining engineer, who operated and managed several mining properties in the Grass Valley-Nevada City area of California, died in Nevada City, Calif., on Aug. 4, aged 62.

Major Frederick W. D. Gwynne died recently at Dieppe, France. He had long been associated with Lena Goldfields, and was manager of that company at the time of his death.

Eulalio Gutierrez, a prominent Mexican mining man who began mining as a boy in the mines of Zacatecas and made a fortune out of the industry, and who was provisional president of Mexico from Dec. 13, 1914, to Jan. 20, 1915, died recently in Saltillo, Coahuila, aged 58 years.

A LETTER

Dry Crushing and Intersticial Cyanidation

The Editor:

MR. H. W. HARDINGE'S letter on "Dry Crushing and Interstitial Cyanidation" in the April, 1939, issue was noted with a great deal of interest.

Cyaniding dry crushed ores in coarse mesh sizes is, I believe, considered good practice, but there are very few, if any, new plants of this type going up. If we may interpret Mr. Hardinge's letter correctly, it appears as though dry fine crushing and/or grinding is advocated. If this is so, would not the decrease in grinding efficiency and convenience in handling, as compared to wet work, overcome any ordinary gain in solubility?

In fine wet crushing or grinding in a ball or pebble mill, the free oxygen content of the solvent is indeed reduced, as Mr. Hardinge states, but he fails to mention that the high degree of agitation produced in the wet grinding operation goes a long way toward dissolving the values in the ore. On an average ore amenable to cyanidation, it is not unreasonable to expect half the total gold to go into solution in the grinding circuit. Such a high degree of chemical activity naturally consumes a large amount of oxygen, but the grinding action also tends to restore some of this.

He also states, "free oxygen is restricted in its combination with the KCN due to the coating of the crushed ore particles with the accompanying liquid conveyor." How else can the gold particles go into solution if not through contact with the solvent (liquid conveyor)? This liquid conveyor is nothing more than water containing oxygen and the soluble products of the original KCN, and CaO.

Just as long as free air bubbles fill the interstices of a dry crushed product (as suggested in the bottom of Mr. Hardinge's second column) the particle will not be wetted by solvent and consequently not dissolved.

I believe the present tendency of using wet grinding in practically all the new cyanide plants is reasonable proof of the efficiency and economy of this method.

STANLEY D. MICHAELSON

I will endeavor to answer Mr. Michaelson's questions: Whether or not coarse or fine grinding is to be advocated depends primarily upon the physical characteristics of the ore, its porosity or density, or crystalline compact mass. I am an advocate of the idea that the resulting compound of a mixture is adhesive rather than cohesive, that atoms of the same element are, in nature, held together by cohesion or mutual attraction, and in spite of the general acceptance of the idea that "nature abhors a void," yet voids theoretically exist like the voids between peas in a pod, and it is this "void" I would fill with concentrated KCN or other chemical molecules acting upon an associated metal element (gold, silver, etc.). It is these voids in both element and compound that I would fill with my strong concentrated solvent, in a more or less dry state, and later extract by dilution and separation from the matrix.

Secondly, Mr. Michaelson suggests the constant renewal of the oxygen in the wet grinding process, but omits to consider that the residual oxygen in an inclosed space is limited to or by its consumption. The probability is, and I use the word probable with reservations—as I have never yet, personally, been within a grinding mill while it was in operation—that the free active oxygen would soon become exhausted and like any biological chemical requirement, without which, the subject would die.

Thirdly, he apparently takes exception to my suggestion that a concentrated solution can be supplied by quantity, such as a weak solution in the conveying medium (water).

Fourthly, he asks whether or not the economic results of "wet grinding" would not be more than compensated for in the additional cost of dry grinding. To this question, considering my minus ¼-in. mesh, practiced in my earlier experiments, and the minus 200-mesh of present practice, and based on many years of experience in the "art," I can conscientiously answer with a "No!" The coarser dry grinding is, in general, the more economical.

Fifthly, Mr. Michaelson's last paragraph suggests "We should let well enough alone." In reply, I still hold to a favorite couplet which is:

"Progress, what is it but an onward move
From here to there out of the wonted groove."

In my "junior matallurgical period of the early 80's, the arrastre with quicksilver and a saving of 60 to 70 per cent was good. Then in my "senior" days of the early 90's there came into vogue the Huntington and the Chile mill, later followed by the stamp mill with amalgamation plates and an 80 per cent saving, which was fairly satisfactory.

Practically all of these devices were scrapped in the early 1900's (long after my "graduation") and the ball mill came into use with cyanide and other chemical reagents as the recovery medium and a saving of 95 per cent plus.

One should not be satisfied, but should push forward, become a "pioneer" and seek a method reaching toward 100 per cent recovery. We need the younger men as future pioneers. You can't recover all of the 100 per cent any more than you can squeeze all the moisture from a wetted sponge.

H. W. HARDINGE

What Metal Statistics Show

METAL PRODUCERS became concerned over their production schedules as copper, lead, and zinc prices rose quickly early in September, when a wave of hysteric buying of all metals set in because of the conflict in Europe. Some observers believe purchases have been overdone and that higher prices will encourage increased production in the face of virtually regulated metal prices abroad, coupled with more foreign copper, lead, and zinc mines ready to supply metal for war needs today than in 1914. Metal statistics during the last quarter will reflect an apparent greatly improved position, and producers are said to be carefully appraising daily events and seeking to maintain stability in the face of hectic markets and an unpredictable future for the domestic industry.

The June and July statistics of the Copper Institute, in short tons, compare as follows:

	June	July
Production, crude:		
U. S. mine	47,833	45,510
U. S. scrap, etc.	11,839	9,022
Foreign mine	89,449	89,477
Foreign scrap	13,115	20,142
Totals	(a)162,236	164,151
Production, refined:		
United States (b)	61,719	57,339
Foreign	111,486	100,897
Totals	173,205	158,236
Deliveries, refined:		
U. S. domestic	53,573	59,681
U. S. exports (b)	10,289	16,127
Foreign	116,571	105,679
Totals	180,433	181,487
Stocks at end, refined:		
United States	335,012	316,543
Foreign	178,658	173,876
Totals	513,670	490,419

(a) Corrected. (b) Duty-free copper.

To relieve a tight situation in copper outside of the United States, the foreign producers participating in production control announced in London on Aug. 10 that the rate of operations is to be increased from the 95 per cent basis, in force since March 1, to 105 per cent, effective Aug. 16. This will increase output by the Cartel from approximately 68,000 tons a month to 74,000 tons.

The Cartel fixed the per cent rate of production as follows, going back to October 17, 1936.

October 17, 1938	Unlimited
December 15, 1938	105
January 1, 1939	100
March 1, 1939	95
August 16, 1939	105

▶ ZINC—The June, July and August statistics of the American Zinc Institute, covering all grades, are summarized as follows in tons.

	June	July	August
Stock at beginning	133,075	135,241	131,782
Production	39,450	39,669	40,960
Production daily rate	1,315	1,280	1,321
Shipments	37,284	43,128	49,928
Unfilled orders	35,874	49,379	44,773
Stock at end	135,241	131,782	122,814

Figures covering operations of the Prime Western division, for June, July and August, follow:

	June	July	August
Stock at beginning	58,808	59,206	58,149
Production	17,881	17,263	17,528
Shipments	17,483	18,320	20,542
Stock at end	59,206	58,149	55,135

E & M J Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922–3–4)

1929	110.33	1934	69.56
1930	82.87	1935	74.66
1931	60.20	1936	73.45
1932	48.26	1937	90.86
1933	59.79	1938	73.67

	1937	1938	1939
January	87.03	75.56	77.12
February	91.68	73.43	76.89
March	103.78	72.41	77.09
April	98.62	71.19	74.79
May	93.25	69.15	73.61
June	93.21	67.55	73.17
July	93.82	72.95	71.95
August	95.28	73.94	73.88
September	94.33	74.70	....
October	85.26	77.61	....
November	78.91	78.36	....
December	75.18	77.13	....

▶ LEAD—"Fear buying" provoked by the European war made domestic lead consumers buy ample supplies of metal as prices rose from 5.05c. to 5.50c., New York, early in September. These prices are expected to encourage increased mine output, in several districts.

The lead-refinery statistics for July show that stocks of refined lead at the end of the month stood at 124,017 tons, a reduction of 5,619 tons compared with a month previous. Following is a summary of the latest figures of the American Bureau of Metal Statistics, in short tons:

Refined lead:	June	July
Stock at beginning	129,270	129,636
Production:		
Domestic ore	37,237	34,926
Secondary and foreign	1,831	2,095
Totals	39,068	37,021
Domestic shipments	38,710	42,636
Stock at end	129,636	124,017

Recovery of Secondary Non-Ferrous Metals in the United States, 1936, 1937, and 1938

(Abstracted from United States Bureau of Mines' Annual Summary)

In Short Tons

	1936	1937	1938
COPPER:			
As metal, by primary smelters	132,915	156,606	92,542
As metal, by secondary smelters	127,085	128,994	99,858
In brass, by secondary smelters, basis 70%	119,300	144,500	107,100
In other alloys, by secondary smelters	105,300	102,000	60,300
Totals, copper	484,600	532,100	359,800
LEAD:			
As metal, by primary smelters	34,556	29,986	24,800
As metal, by smelters that treat scrap and drosses	102,944	124,514	94,600
In antimonial lead, by primaries	12,930	15,391	11,170
In drosses and scrap alloys, by secondaries	112,470	105,209	94,330
Totals, lead	262,900	275,100	224,900
ZINC:			
As metal, by primary smelters	22,142	24,131	14,003
As metal, by secondary smelters	45,858	(a)40,409	28,267
In brass (estimated)	42,600	51,600	38,400
In other alloys	11,500	11,150	6,400
Totals, zinc	122,100	(a)127,290	87,070
TIN:			
As metal, by detinners	2,564	2,850	2,891
As metal, by others	4,686	5,420	2,009
In alloys and chemical compounds	20,770	22,030	18,710
Totals, tin	28,020	30,300	23,610
ALUMINUM:			
Unalloyed	20,900	29,360	16,700
Recovered in alloys, mainly No. 12	30,600	33,200	22,100
Totals aluminum	51,500	62,560	38,800
NICKEL:			
As nickel	855	917	850
In non-ferrous alloys and salts	1,110	1,483	1,450
Totals, nickel	1,965	2,400	2,300
ANTIMONY:			
As metal, secondary smelters	9,209	11,487	7,771
In antimonial lead scrap at regular smelters	691	853	729
Totals, aluminum	9,900	12,340	8,500

(a) Revised figures.

CALIFORNIA

Ruck-A-Chucky Debris Dam To Be Started Soon

Project will serve hydraulic mine operators in El Dorado County—Employees of Empire Star Mines approve hospital plan of their company

▶ Bids for construction of the third débris dam, the Ruck-A-Chucky, were opened on Aug. 23 in the offices of Col. Lincoln B. Chambers, district engineer for the United States Army Engineers in Sacramento, and work on the new project is expected to be started in 30 days. The site is 10 miles above the confluence of the North and Middle Forks of the American River in El Dorado County.

▶ The plan to establish a non-profit hospital association submitted by Empire Star Mines Company, Ltd., to its employees was approved by them by a vote of nine to one. Under the proposal a hospital is to be built by the company, which subsequently will be leased to the Miners Hospital Association, a non-profit organization. The hospital will be equipped fully to take care of all compensation cases arising at the different mines operated by the company in the Grass Valley-Nevada City area and also to offer complete hospital and medical service to the company's employees, including services to dependent members of employees' families at special reduced rates. John Mann is general manager of the company.

▶ Diamond drilling operations are in progress at the Hallstead gold mine, near Virgilia, Plumas County, which was optioned recently by the Mountain Copper Company, Ltd. William F. Kett, with offices in the Balfour Building, San Francisco, is general manager of the company.

▶ Early construction of a 150-ton flotation mill at the Cherokee mine, Greenville, Plumas County, is planned by A. L. Merritt, of New York and San Francisco, who reopened the property early this year. Frank Humphrey is superintendent.

▶ Rehabilitation of the 2,000-ft. shaft is under way at the Dead Horse mine, near Sonora, Tuolumne County. Joseph King, the operator, has completed the installation of a headframe and air-compressor equipment.

▶ Plans for the erection of a 100-ton mill at the Giant King mine, at Washington, Nevada County, have been completed by W. E. Narkaus and C. Patterson, who have recently reopened the property following an eight months' shutdown. The holdings, owned by William Luce, of Reno, Nev., comprise about 100 acres. John Rondoni is superintendent.

▶ The Uncle Sam property, near Kennett, Shasta County, owned by the Dakin Company and formerly operated by the defunct Vera Mines Corporation, has been taken over under lease by the Butler Mining Corporation. Construction of a 100-ton mill by Dec. 1 is planned. E. L. Spencer, of Santa Barbara, is president and general manager.

▶ Good progress is being made in the construction of a new 250-ton cyanide plant at the Greenhorn mine, at French Gulch, Shasta County, acquired recently by Willow Creek Mines, Inc., Walter Lyman Brown, president. Operations are directed by C. L. Cooper, general superintendent, and erection of the mill is carried out by Western-Knapp Engineering Company, 760 Folsom St., San Francisco.

▶ Development is in progress at the Homer V. Madden gravel mine, near Placerville, El Dorado County, leased recently to H. A. Wootton, of New York, and associates. At present operations are on a one-shift basis.

▶ About 30 men are employed, under the direction of A. S. Wyner, superintendent, at the property of San Juan Ramsey Company at Clearinghouse, in Merced River Canyon, Mariposa County, where a ten-stamp mill is now in operation handling ore broken from three different stopes. The company is headed by W. C. Smith, 50 Congress St., Boston, Mass.

▶ A 60-ton mill has been completed and milling of 100,000 tons of dump material has been started at the Plumas-Eureka mine, near Johnsville, Plumas County, operated by Col. R. W. Cunningham.

UTAH

Two Lead Smelters Resume Operations

About 500 men return to work at Murray and Midvale plants—New Park Mining Company encouraged by development of good ore

▶ Two of Utah's smelters—the Murray smelter of the American Smelting & Refining Company and the Midvale smelter of the United States Smelting, Refining & Mining Company—resumed operations, the first on Aug. 8 after a shutdown since last spring and the second on July 28 after a three weeks' shutdown for routine repairs to the main stack. Nearly 500 men returned to work.

▶ The New Park Mining Company has opened up an encouraging showing of ore on the 550-ft. level in its Park Galena property. Excellent progress is being made in extending the Mayflower Tunnel to get below the Park Galena workings. W. H. Cranmer was reelected president on July 15 and Fraser Buck, of Park City, was elected secretary. Offices of the company are being moved from Salt Lake City to Keetley, in the East Park City district near the mine.

▶ Park Bingham Mining Company has increased the production of its Bingham property to 3,000 tons a month. About 130 men are employed including leasers. Production consists of two types, a siliceous gold-silver ore and a silver-lead-zinc ore.

▶ The body of gold ore first struck on the North Lily 1,300 level in a southwest drift has been developed on the 1,350 and 1,200 levels. Discovery of a low-grade orebody on the 1,400-ft. level indicates that the ore may persist and make into the Eureka Bullion property.

▶ The Silver King Coalition Mines Company, which resumed operations on May 8 after a year's shutdown, reports a net profit for the second quarter of the year amounting to $46,607.27 after all taxes and depreciation but before depletion. This is equal to 3.8c. a share on the 1,220,467 shares of stock outstanding. For the year ended June 30, 1939, the company reports a net loss of $125,433.51 after all taxes and depreciation but before depletion, or equal to 10.3c. a share.

▶ The Crystal White Salt Company has started production of salt from the brine of Great Salt Lake at its new solar evaporation plant on Stansbury Island near the south end of the Lake. R. B. Elderkin, of Salt Lake City, is secretary-treasurer and general manager. An electrical pumping plant and a 3½-mile canal to carry the water to the solar ponds have been installed.

▶ Dr. R. S. Dean, chief engineer of the metallurgical division of the United States Bureau of Mines, arrived in Salt Lake City on July 28 to establish headquarters here for the division in the new $300,000 building at the University of Utah, which will be ready for occupancy about Nov. 1. G. L. Oldright, formerly supervising engineer for the Salt Lake Bureau of Mines station, will remain as senior metallurgist.

▶ Administrative offices for the Garfield and Magna mills of the Utah Copper Company were moved on July 25 to a new two-story office building at the Garfield plant. The old office building is being remodeled for chemical and assay laboratories of the company. The two-story office building is built of brick, concrete, and steel.

▶ Employees of the Arthur and Magna mills, Utah Cooper Company, have selected the Independent Association of Mill Workers, a local union, to represent them in collective bargaining with the company. A 784-to-531 vote designated the local union as the sole bargaining agent rather than the International Union of Mine, Mill and Smelter Workers, local No. 362.

▶ The Wasatch Gold Mines Corporation, reports C. S. Woodward, president of the company, has driven its adit in Mineral Fork, Big Cottonwood Canyon, a distance of 1,325 ft. George L. Price is taking ore out of the upper workings.

▶ Placer mining is being conducted by the Mineral Valley Gold Mining Company at its property in Amasa Valley, 48 miles southwest of Delta, according to George Taylor, manager.

Performance Facts
ONE OF A SERIES

"DORR MAINTENANCE COSTS?"

"2 CENTS A TON WILL COVER ALL 12 UNITS, 1 FIGURE!"

Maintenance costs on Dorr installations are so small that few mill superintendents bother to segregate them.

Yet this particular mill superintendent had figured it out to three decimal places—had all the answers ready when the General Super strolled through the mill, looking for places to cut costs.

Here are the figures (an actual case) jotted down in the mill records for a two years' period.

Maintenance—		
3 Dorr Agitators	$ .006	per ton milled
4 Dorr Thickeners	.002	" " "
4 Dorrco Pumps	.003	" " "
1 Dorr Classifier	.008	" " "
Total	$ .019	per ton milled

Hand picked case? Surely, but there are countless reliability records in our files almost as good.

After all, we've been at it for 35 years—building equipment to last, to give years of trouble-free service under day in, day out punishment. And we do know our job.

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ARIZONA

Several Small Mines Increase Production

Gold and silver properties proceed with plans for larger mill capacities—New 200-ton smelter at Orizaba mine near completion

▶ At the American silver mine, in the Harshaw district near Patagonia, a new camp is being constructed including cabins, an assay office, a change room, and a power house. The work is under lease by J. H. Macia, Jr., of Patagonia.

▶ It is reported that the Oatman Eastern Gold Mining company is to build a 100-ton cyanide plant on the Adams property, in the Katherine district. James J. Moss is head of the company.

▶ W. N. Sim, operating the Commonwealth mine, near Pearce, is putting in additional equipment to bring the mill capacity up to 150 to 200 tons daily.

▶ The Broken Hill claim, two miles east of Ray, was recently taken over by Dye and Bothrick, who are working a crew of five men.

▶ The new 200-ton smelter at the Orizaba mine, operated by the Allied Mining & Smelting Company, is nearing completion. A new headframe and 5-ton skip; an Ingersoll-Rand duplex compressor; ore bins, and roads have been constructed. H. D. Mollohan, Black Canyon Highway, Phoenix, is general manager of the property, and David Feuer, of Long Beach, Calif., is president.

▶ The Lucky Strike gold, silver, and copper mine four miles south of Rittenhouse, in the Blackwater district, is planning the installation of a compressor for a 300-ft. tunnel to cut the main ledge. Bat Gays, of Superior, is owner of the property and is under lease to Sam Cooper, of Higley.

▶ Big Eagle Mining Company is operating two properties in the Aguila section—the Walter's mine, a short distance north of Aguila, and the John Rogers property, 17 miles southwest. Ten men are employed under the direction of Ed. Husson, of Aguila.

▶ The American Smelting & Refining Company, operating the Trench mine, at Patagonia, under lease, is doing development work on the 700-ft. level. A crew of 115 men are employed. The company has leased the shaft at the Hardshell mine, and water from it is being used in the milling operations. M. B. Lovelace is superintendent at the property.

▶ The 60-ton milling plant of the Hazeldel Mining Company at Vicksburg is treating gold, silver, and copper ore from the Desert mine, operated under lease from Dr. C. D. Lesher. G. Clark Rhodehamel, of Vicksburg, is general manager.

▶ American Smelting & Refining Company's plant at Hayden closed down July 29 for a period of two months. The plant will continue to receive ores, however, during the period of the shutdown. H. F. Easter is superintendent in charge.

▶ The Julius gold property near Quartzite, operated by T. E. Bartlett, recently started production at the mine and mill. Ted Phillips is superintendent.

▶ The Old Woodchopper claim, a part of the Evahom group of claims in Mineral Park near Chloride, has recently been taken over, and the first carload of ore was shipped in August. Many improvements are being made at the mine and camp, and shipments are expected to increase. A. Russell, of Chicago, has associated himself with J. E. Mitchell, owner of the property, and will be in charge of operations.

▶ Mrs. Bryce H. Westlake, of Globe, has leased a group of 56 tungsten claims in the Sulphide del Rey district, in the Pinal Mountains, to P. H. Lund and J. R. Gano, of San Antonio, Tex. The erection of a mill is planned to produce a tungsten concentrate.

▶ An area of 1,200 acres of placer ground has been acquired in the old La Paz district near Ehrensburg by Robert G. Beatty, of Hamburg, N. Y., and Karl H. Kempfe, of Buffalo, N. Y. A complete sampling of the gravels is now being made and a washing plant of 1,000-cu.yd. capacity may be installed.

▶ Installation of a 50-ton mill is under way at the Scribner mine, in the Swisshelm district near Elfrida. The property is being operated by Herry Lorin and P. A. Morse, of Douglas and Safford.

NEVADA

Molybdenum Deposits Being Prospected

Property in Esmeralda County will be diamond drilled—Bureau of Mines begins investigations in Nightingale tungsten district

▶ Representatives of the Freeport Sulphur Company, of New York and Freeport, Tex., have secured an option from southern Nevada men on claims embracing large molybdenite deposits in Alum Gulch, in southern Esmeralda County, for a reputed purchase price of $425,000. Further prospecting will involve extending a 500-ft. tunnel and diamond drilling. The options, from two groups of owners, were obtained for L. M. Williams, Jr., president of the Freeport company, through attorneys of Salt Lake City.

▶ First survey and test project in Nevada under the recent act relating to strategic war minerals will be conducted in the Nightingale tungsten district, near Winnemucca Lake, in western Pershing county, it was announced by William O. Vanderburg, engineer for the United States Bureau of Mines, who makes his headquarters at the Mackay School of Mines, in Reno. A dozen men will be employed in trenching, sampling, and mapping the area, and this may be followed by diamond drilling. Gold, Silver & Tungsten, Inc., with main offices at Boulder, Colo., has large scheelite deposits in the district and operates a 100-ton flotation mill.

▶ Extensive sampling of the old Flowery and Lady Bryan mines, adjoining in lower Six-Mile Canyon below Virginia City, has been conducted lately by employes of J. H. Marsman & Company, under the direction of J. O. Enberg, chairman of the board of engineers of the Marsman organization, one of the leading metal producers in the Philippine Islands. Marsman engineers have recently examined a number of Nevada mine properties.

▶ Installation of additional grinding units acquired from the Denver Equipment Company has increased to 60 tons per day the capacity of a cyanide mill completed recently by the Westgate Mining & Milling Corporation at Westgate, in central Churchill County. Custom ore is trucked to the plant from a number of districts, including Fairview, Wonder, Eastgate, Broken Hills, Rawhide, and Manhattan. The enterprise has been brought to a successful stage by Edward S. Montgomery, with whom N. H. Getchell, manager for the Getchell Mine, Inc., is said to be associated. Victor Jacobson is mill superintendent.

▶ Additional furnace equipment has been delivered at the Castle Peak quicksilver mine, 8 miles north of Virginia City, acquired recently by the American Quicksilver Corporation and now being prepared for major production. A new winze is said to have developed a substantial tonnage of cinnabar of highly profitable grade. William N. Albee, 2404 Eaton Tower, Detroit, Mich., is president and R. D. Gardner, with office at Virginia City, is vice-president and directing engineer.

▶ Lateral work is in progress on the 500-ft. level of a new vertical shaft on property of the Rio Grande Copper Company in the Mountain City district, Elko County, operated under lease and option by a subsidiary of the Sunshine Mining Company, of Idaho, largest American silver producer. The mine was closed down lately for six days during an examination by E. N. Pennebaker, geologist for the Consolidated Coppermines Corporation, reputedly in connection with the Sunshine option. B. K. Zerbe, formerly superintendent for the company in the Coeur d'Alene district, is in charge.

▶ Activity in the Mountain City, Elko County, sector has been augmented by several new operations. The recently organized Mountain City Mercur Mines Company is taking out high-grade gold-silver ore at its property in the Van Duzen district, 12 miles southwest of Mountain City. Gordon McMillan, Salt Lake engineer, is in charge of operations. A compressor was recently installed.

▶ Leasers at the Centennial Gold Mining Company's Bull Run mine, 12 miles southwest of Mountain City, are operating a new 100-ton Gibson mill. The mine is being operated by Edward J. McPolin and J. Norman Neil, of Park City, Utah, on a long-term lease.

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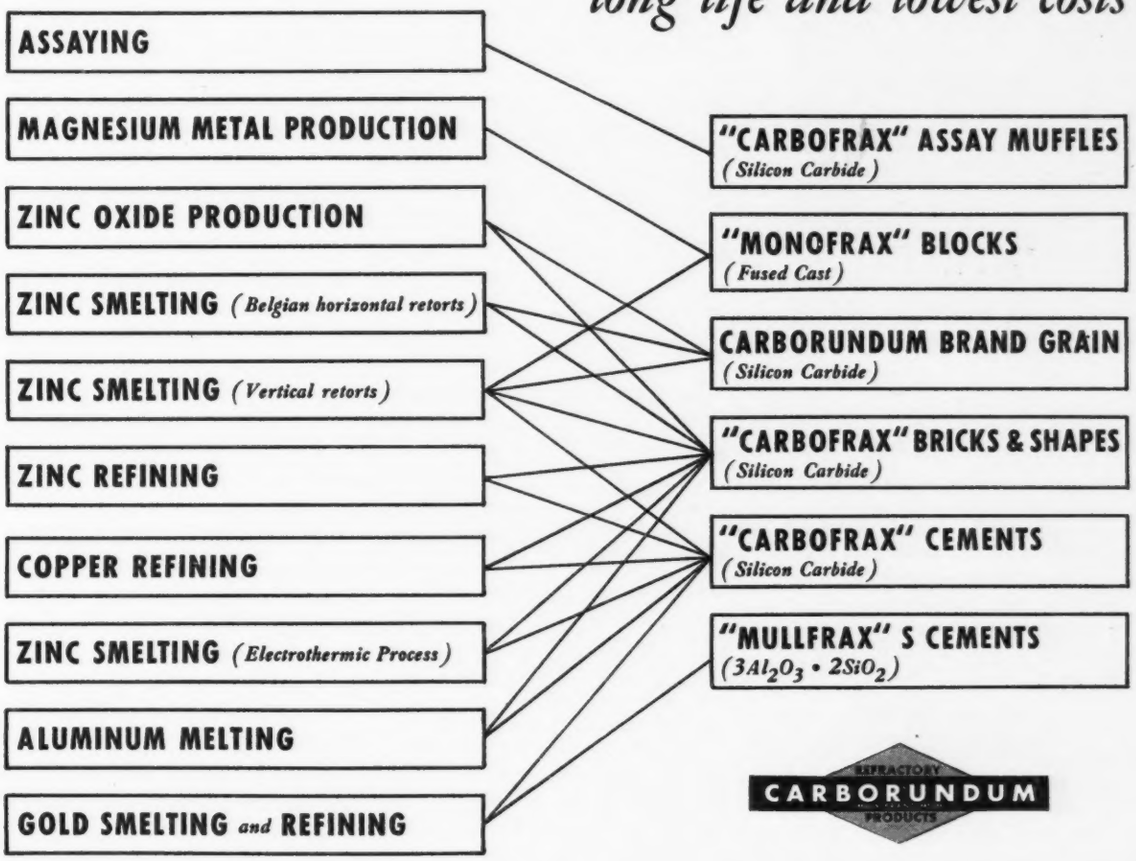

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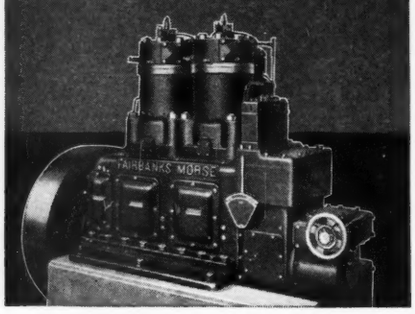

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Western Governors Meet To Boost Price of Silver

▶ Following the meeting of the American Mining Congress in Salt Lake City, representatives of ten Western States convened on Sept. 1 to continue their efforts to obtain a higher price for silver, with the ultimate objective $1.29 per ounce. The Governors of Utah, Nevada, and Arizona were present in person, six others sent official appointees, and the Governor of Washington sent a message pledging his cooperation. Senators Key Pittman and Patrick A. McCarran, of Nevada, were also active at the conference. The theme of the meeting, expressed by Senator Pittman, was the formation of a bloc for regional cooperation, one that could make its voice heard in Washington, D. C.

A resolution, unanimously adopted, contained the following reaffirmation of the position taken by the Western Governors at Reno, Nev., March 29, 1939:

"1. We favor a metallic base for United States currency, with the employment of both gold and silver in such base.

"2. We favor continued acquisition by the United States treasury of all newly-mined silver tendered to it.

"3. We favor the acquisition by the United States of foreign silver, provided the proceeds of such acquisition shall be used to promote or increase the sale of agricultural and industrial products of the United States in foreign countries.

"And in connection with United States treasury acquisitions of silver, we call attention to the fact that all such acquisitions are settled for through the coinage of silver or the issuance of silver currency and therefore result in no expenditure from the tax revenues or other funds of the United States treasury.

"The prosperity of the mining industry of the west contributes in large measure to the economic welfare of the entire nation."

IDAHO

Silver Dollar Mine Begins Production

Ore will be concentrated in the Galena mill, leased to the company—Silver producers spur activity as mines reopen and mill capacities are increased

▶ The Silver Dollar Mining Company has taken a lease on the Galena mine mill, owned by the Callahan Zinc-Lead Company in Lake Gulch, west of Wallace, and will start regular shipments early in September. The mill is a modern flotation plant and can treat 200 tons daily. It is about 6 miles from the Silver Dollar mine. Ore is now available for treatment from the 1,700-1,900 and 2,100 levels of the mine and it is planned to operate the mill at capacity. The Silver Dollar is in the silver belt of the Coeur d'Alenes, in the Sunshine-Polaris area.

▶ Sunshine Consolidated, adjoining the Sunshine on the west, is to be developed from the 3,100-level of the Sunshine shaft, a drift from this deep level to be extended into Consolidated ground. Sunshine is now drifting west on this level, carrying a full face of ore which Consolidated owners believe will continue on into their ground. W. M. Yeaman, of Yakima, is manager.

▶ Moose Gold Mining Company has been formed to operate the South Fork mine, at Elk City, central Idaho. A 40-ton stamp mill will be erected at once, the management reports. A. T. Slawson is in charge of the mine and H. D. Barclay will build and operate the mill.

▶ The Jack Waite mine, in the Murray district of the Coeur d'Alenes, and operated by the American Smelting & Refining Company through the Federal M. & S. reports opening a body of lead-silver ore more than 6 ft. wide on the 2,000-ft. level. The ore was opened on the Montana side of the property and marks the strongest ore resource yet found in the mine, the great depth of the disclosure insuring a large tonnage. The mine has been a steady producer for many years.

▶ Offices of the Callahan Zinc-Lead Company have been moved from Wallace to New York. Local company affairs will be in charge of Paul Brislawn, with headquarters in the Idaho First National Bank Building. Frank Eichelberger recently resigned as manager and director of the company.

COLORADO

Carlton Drainage Tunnel Speedily Advanced

Labor Day contests demonstrate efficient mechanization of drilling and mucking arrangements that permit rapid operations in long project

▶ On Labor Day, Sept. 4, a drilling and mechanical loading contest took place near the Carlton tunnel. Four Ingersoll-Rand automatic drills mounted on a jumbo, manned by three crews of eight men, drilled four 8-ft. holes in disintegrated granite. The winning team, consisting of drillers Leber, Smith, Williams, and Cartee, averaged 3 min. and 16 sec. for each hole drilled. In the single-hole drilling contest Brewer and Zisk drilled an 8-ft. hole in 1 min. and 55 sec. In the mechanical loading contest, participants employed a No. 21 Eimco 9-cu.ft. automatic loader. Contestants had to fill three cars of 3-cu.yd. capacity. The winner was Henry J. Behrens, who averaged 2 min. and 39 sec. per car. The tunnel is 8 miles below Cripple Creek and the project is undertaken by the Golden Cycle Corporation. Alfred Bebee is vice-president in charge of operations and John Austin, superintendent. The 9x8 ft. tunnel was started July 13 and is now

in about 1,700 ft., 1,200 ft. having been driven in August.

▶ Due to the increase price of silver, F. D. Willoughby, president and general manager of the Midnight Mining Company, intends to double the production of the mine and to operate the 50-ton mill 24 hours daily. A diesel electric power plant is being installed.

▶ The Cobalt Mining Company, Boulder, under the direction of President Henry J. Von Wyl, of Denver, recently completed diamond drilling sixteen holes totaling 2,520 ft. They have determined that the nickel ore goes to a depth of about 100 ft. below the lower tunnel level. Further diamond drilling has been recommended by J. H. Rodgers, of Denver. Ward Yeager is general manager.

▶ Kissell and Underwood have leased the Boston Mill, with the intention of establishing a modern plant. They expect to treat custom ore. Mr. Kissell is operating the B&M mine, in the town of Ward.

▶ The Ward mine is being operated by Walter A. Moore, president of the Colorado Gold & Silver Trust Company. The management reports rich ore recently opened up in the tunnel.

▶ K. F. Fulton has completed the Logan mill and started treating ore. Ore in this mill is run over rag tables which catch considerable free gold, and then flotation completes the operations. T. K. Scott, general manager of the Associated Mines, Inc., is preparing to sink on the Sunshine mine. The operators have already pushed deeper development in the Ingram shaft, which is now 1,000 ft. deep.

Labor Day mucking contests at the Carlton tunnel required mechanical loading machines instead of the well-known "muck stick." This operator loaded three 3 cu.yd. cars averaging 2 min. 39 sec. per car.

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NEWS FROM Washington

By Special Correspondent

WAR PLANNING will continue a major job of Washington this fall. And this planning is being done in a realistic, businesslike fashion. Many of the executives of Washington both inside and outside the military departments can personally recall the great losses and long delays of 1917. They do not contemplate any repetition should the United States have need to arm or fight.

Many officials, like the President, saw first-hand what failed and what succeeded in supplying a great fighting force. All of these have welcomed the establishment at this time of the War Resources Board. The influence of that new agency will reach everywhere soon, though it is now only advisory to the Army and Navy Munitions Board. Even mining would be under its intimate direct control in the event of hostilities, for "in an emergency the War Resources Board would become an executive agency of the Government with broad powers similar to those of the old War Industries Board."

The initial membership of this Board has inspired only compliments. Prospective enlargement is to include adequate representatives of other industry and other skills. The result will remain a compact working agency. But it will be the great national board of direction if, unfortunately, Uncle Sam ever were confronted with a military job to do himself.

Active During Recess

CONGRESS went home leaving a very large number of its important tasks unfinished. Some of these proposals will die during the recess by changing conditions. Otherwise all of the legislation remains in status quo, awaiting the next session of the 76th Congress. During the recess there will be about a dozen important investigations by special committees. Several of these projects have importance for mining.

The House of Representatives left more than usual investigative activity on the desks of special committee chairmen. Thoroughly disgusted with relief policies, gravely doubting N.L.R.B. activity, and highly critical of other affairs, the House authorized these special studies. Next session there will be reports on how WPA ought to be reorganized, whether N.L.R.B. should be reformed or abolished, what tax revision is needed, and a half dozen other important reports.

Senate committees are working on the national banking and monetary situation, on the civil liberties problems (under La Follette), and continuing certain potash and phosphate studies (but these are not likely to give any very fundamental shifts, it now appears).

The Temporary National Economic Committee, representing House, Senate, and executive departments, continues its studies of insurance, construction, petroleum and steel industries, and the broad anti-trust problems of business and government. Hearings are already under way, with new main themes to be considered at intervals of about two weeks from now to March 1, when final report of T.N.E.C. is hoped for.

Buying Strategic Minerals

AS FORECAST in this column last month (See *E.&M.J.*, August, 1939, page 96) Congress decided to appropriate only $10,000,000 for immediate use in the purchasing of strategic materials. Most of this will be spent for mineral commodities. The purchases will be made by the Treasury Department under the customary technic of bids and contracts commonly employed by the Procurement Division. Instructions regarding the quantity and quality of minerals to be purchased will be formulated in accordance with the terms of the law by the military authorities, with the advice of certain named civilian departments.

The very limited sum immediately available is causing some delay in arrangements for purchase. Had a larger amount of money been available, it would have been less difficult to determine what items should be procured immediately, and in what amounts. Two other causes of delay are obvious:

1. In the first place, Uncle Sam cannot tell at the moment whether it is going to be possible to expect deliveries from certain parts of the world in the near future. In the event that Mars take entire charge of Europe, it would obviously be silly to contract with any firm whose country was deeply involved. Such enterprise would obviously have no energy to spare for Uncle Sam's stockpile building.

2. In the second place, commitments for delivery at fixed price cannot be expected on certain of the most-wanted commodities. Contractors, even those offering in good faith, cannot be expected to give most favorable prices under present circumstances.

One commentator, remarking on the situation, said: "The building of stockpiles started four years too late." This is obvious, for purchases during the past four years would have been vastly more economical; and the piles hoped for after a four-year program would be very comforting if they were actually in existence today within the United States. But despite complications, the beginning of purchases is expected during September. Any firms that wish a chance to bid on any of the minerals or metals which may be bought should so indicate to Procurement Division, Treasury Department, and they will then be given notice of offering dates and terms as these are announced.

Mineral Field Studies

DETERMINING available mineral reserves potentially useful in wartime has become the most pressing joint task of the Geological Survey and Bureau of Mines. These agencies were provided with one-half million dollars for use this fiscal year by the final appropriation act of the last Congressional session. The geologic exploration of the Survey and the mining and metallurgical studies of the Bureau are being closely coordinated. The field work has already started.

Industry observers will note that these government studies have an avowed objective essentially different than that of the commercial mineral investigator. The objective of the government men is to find where there are large mineral deposits from which strategic metals could be recovered in case imports were cut off. The economic and commercial considerations of profit making, which limit the investigator working for industry, are rightly ignored by these Government investigators. Official parties want to know, when they are done, about how much each mineral would cost if developed from subcommercial deposits. But more importantly they want to know that there is such a deposit from which the mineral actually could be recovered in case of need. They hope that industry on-lookers will recognize this important distinction, and not be critical of undertakings that are obviously non-commercial in their nature.

The Bureau of Mines has organized eight project crews. Each crew is headed by a mining engineer with whom is associated a competent geologist. The crews vary in size and make-up according to the type of project which they are to attack. Flexibility in organization, size, and even number of crews is to be maintained.

Extreme pressure is being brought on the Bureau to make commitments for the exploration of the many reported occurrences of the seven important metals which are being studied: antimony, chromium, manganese, nickel, quicksilver, tin and tungsten. For the present only these are to be investigated; if the Army and Navy Munitions Board asks for other studies later, they will be added. A large list of localities to be studied has been made up. Each project will be reached as soon as practicable. Those disappointed in the fact that they are not on the list of the first undertakings should not be discouraged. Even those which the Government expects to reach a few months from now have not been so notified. This restriction has been imposed in order that changes of plans can be made from time to time as conditions make desirable without disappointment of those prematurely notified.

There will be many factors causing shifts of crews and changes of plans. Initially, eight important and promising locations have been chosen, "regardless of politics." But changing season, results of first tests, and new information will frequently cause the moving of a project crew from one location to another. As the men get experience, some of the junior workers will be put in

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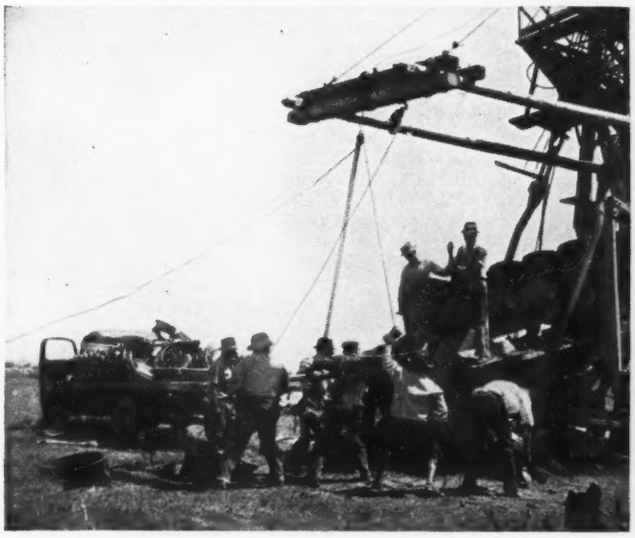

SNELLING GOLD DREDGING COMPANY – No. 1 DREDGE
The Efficient Crew and Matchless Tisco Bucket Design Cooperate to Change Rivetless Lips in Record Time

By Staff Correspondent

SNELLING, Calif., June 26.—The Snelling Gold Dredging Company relipped the bucket line for the third time on No. 1 dredge today and made history. The officials, F. J. Estep, Vice President and General Manager; R. K. Estep, Secretary and Assistant Manager; and Evan Estep, had decided to get the job done and out of the way in a hurry, and they succeeded. It was nothing new for them to change Tisco Rivetless Lips. No. 2 dredge was equipped with these time-and-money-saving buckets when originally built in 1934. No. 1 dredge was equipped in 1937 and 1938.

As a labor saving kink, Art Vermillion, dredge-master in charge, built a wood jib to support a hoist and ram. The dredge was shut down at 7 o'clock in the morning and one-half hour was consumed in installing the rigging shown in the photographs. At 7:30 o'clock relipping started and was completed on the entire line of 65 buckets at 10:45. The rigging was removed in 10 minutes, and the dredge started digging again at 10:55 A.M. This represents 3.06 minutes per bucket in total elapsed time, including installation and removal of the equipment, and exactly 3 minutes per bucket for the relipping operation only.

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charge of new localities, and a larger number of projects may be under study simultaneously.

Quite a number of cases are listed where only a reconnaissance or scouting study is first planned. Whether there will be a more detailed effort at appraisal or blocking out will depend partly on the findings of this preliminary work and partly on the urgency of the need for one class or another of information as the work develops. In some cases a very limited amount of drilling will, it is believed, suffice to supplement the detailed studies of geologists. In others it may be that preliminary work by the Government may stimulate commercial interests to carry on the more expensive blocking-out projects. That result would, of course, be welcomed by the Government men, as it would permit saving of limited Government funds for numerous other undertakings.

More Tariff Changes

THE DUST of Congress's departure had hardly settled when the State Department began announcement of new trade agreement negotiations planned. An elaborate review of the trade agreement with Belgium was announced soon after mid-August. A long list of commodities has been published, indicating the wide scope of the reconsideration of the existing agreement which is contemplated. This list includes numerous non-metallic minerals and primary products from minerals, a substantial list of steel products, and a few chemical commodities of concern to the mining industry. Most of the items listed are those on which earlier agreements have already made tariff reductions, or fixed rates binding present duties or free-list status.

The second specific announcement of a new trade agreement relates to the Argentine. Great emphasis is laid by the State Department on the importance of cementing Latin-American friendship by the offer of reciprocal benefits by the United States. The hope earlier expressed that some similar negotiations might be undertaken with Mexico appears futile in view of recent controversies over expropriation of American property by that country without prompt arrangement for compensation of the owners.

Non-Metal Strategics

MINERAL ECONOMISTS of the Government have been studying some of the mineral problems of wartime supply from the standpoint of nonmetallics that are needed for particular purposes. Such questions include certain high-purity glass raw materials (especially for optical glass), quartz crystal, and mica. The highly specialized applications of quartz crystal and mica have required some very detailed technical inquiries. Neither the quantity nor the dollar value of these materials is very great. But the importance in case of a military emergency might be extreme.

Sheet mica, already split, might be required up to about four million pounds per year for numerous purposes. But vastly more important are certain special kinds of mica used in condensers, for radio, and in aircraft spark-plugs. Some of these grades range in value up to $20 per pound, but the quantities used are small. The experts estimate that altogether the mica requirements could readily be satisfied with a million dollar stockpile, or perhaps less; early purchases are, however, not expected.

Wages and Hours at Mines

PROPOSED REVISIONS of the Fair Labor Standards Act broke down completely when Administration leaders became convinced that any bill which could be enacted would so weaken or narrow the scope of the present law as to be objectionable to the President and Administrator Andrews. Thus, the few benefits which the mining industry hoped for were lost.

The next session of Congress will take up this project again. There will be renewed pressure for clarification and simplification of the law. The urgency of this will be increased by the changes which take place automatically on Oct. 24. After that date the minimum wage permissible becomes 30c. per hour and the maximum time permissible will be 42 hours per week without time and one-half for overtime.

Plans of Administrator Andrews to organize an enforcement staff in the field will also probably help those who would like to put through "a reasonable set of amendments" during the next session. Incidentally, real enforcement effort will begin soon, though no such "crack-down" as may be recalled from old N.R.A. days.

Those seeking specific measures of relief for the mining industry will be met by counter proposals. It must be expected that those who would clarify or simplify application of the Act must do so with changes in harmony with the spirit of the whole law. Proposals merely to weaken the law or reduce the number of persons benefited by it will not be acceptable, and probably cannot be forced through Congress without excessive cost.

It is understood that the mining industry wants two specific forms of relief. One of these would permit long hours without overtime in remote mining districts, or in those where climatic conditions or high altitude make a short season necessary. The second proposal reported deals with a more satisfying definition of "hours worked," particularly with reference to the time taken by workmen in reaching their work places or in participating in nonproductive activities.

It appears that the first of these benfits can be hoped for, with Andrews' encouragement, only where generous employment contracts are in force, limiting the total time worked per year or per six months. The second proposal probably could be had through an interpretative statement of the Administrator, if Mr. Andrews were given the authority by Congress to make such interpretation in the form of binding orders.

Congress is sure to have a difficult time handling further revision of this law next winter. Not the least of the problems then expected is the question as to whether by log rolling a group of agricultural factions can manage to take a large number of workers out from under the provisions of the law. The President and the Administrator would rather work with the present difficult law than to accept any such result.

News "Fines"

New Mineral Uses—Much of the emphasis of the proposed new research by the Government with respect to fuels is on the idea that the Government should find new ways in which to use more anthracite or more bituminous coal or more of some other commodity. There is little evidence that Uncle Sam is being urged similarly to seek new uses for the metals and non-metallic minerals. One observer from outside the industry asks pointedly why the Government does most of its work on new methods of production of these minerals and metals already in surplus. Why, he inquires, does not Uncle Sam work more on new uses for them?

Patent Restrictions—Congress passed five bills late in July which restrict the opportunity to get or use patents. None of the bills changes the patent law fundamentally, but all speed up or limit the opportunity of inventor and patent owner. These laws signed early in August by the President provide for: (1) Abolition of renewal applications; (2) reducing from two years to one year the period during which an inventor may make public use of his invention before filing an application; (3) simplifying and speeding up of interference practice; (4) requirement that an applicant respond to Patent Office actions in less than six months when so ordered, under certain conditions; and (5) reducing from two years to one year the period within which an inventor may copy claims from an issued patent for the purpose of compelling interference proceeding.

Price of Silver—Official Washington alleges great satisfaction in the fact that official quotations of 35c. for purchase of foreign silver are lower than commercial quotations. The Treasury would not be at all unhappy if this price relationship could be continued indefinitely, making further silver purchases almost unnecessary because of very limited offerings. In any event, Congress is not likely to forbid foreign silver purchases, though a small group made a brave gesture of such legislation in July.

Mineral Barter—Congress provided the President with means for working out further mineral barter using American surplus cotton in the trade, if he could arrange a deal. Officials are most anxious to get tin in this fashion, but apparently are not very hopeful of success.

Small Mine Loans—Members of the Senate tried to insert in the proposed spending-lending bill a sum which would have been used for loans to small mining property owners, in sums not exceeding $5,000 to any one borrower. This idea was defeated. This seems to mean that Congress believes in having such loans arranged through existing agencies like R.F.C.

American Mining Congress Discusses Leading Problems of the Industry

Salt Lake City attracts many members during eventful week

INDICATIVE of its significance to mining men from all parts of the United States, the Sixth Annual Metal Mining Congress and Exposition attracted to its program at the Minerals Building on the State Fair grounds, Salt Lake City, Aug. 28-31, a large number of mine operators, executives, engineers, and their guests. Problems such as minerals and national defence, prospects for metals, the future of silver, improved working methods and new equipment, industrial relations, the Wagner Act, occupational disease legislation, reciprocal trade agreements, mine financing, taxation, the Wage-Hour Act, and safety and health of workers were aired and discussed. All sessions were well attended and discussions were constructive. Improvement of old products and machinery and development of new ones were on display at the large machinery exposition, where the manufacturers' representatives explained and gave advice anent the equipment displayed to the caller. Typical Western cordiality and hospitality reigned, and D. D. Moffat, chairman, Western Division American Mining Congress; Geo. H. Rupp, national chairman, program committee; James W. Wade, general chairman, arrangements committee, and Secretary Julian D. Conover and James Ivers, governor, Utah Chapter, are to be congratulated on the excellent program and fine entertainment offered.

Secretary Julian D. Conover formally opened the convention, stating that current domestic and international matters had since the last meeting raised new problems for the mining industry and had given a new meaning to many of the old. Following these remarks, chairman William Loach, vice-president, Wolf Tongue Mining Company, called to order the morning session. In his interesting address, entitled "Strategic Minerals Investigations by the Bureau of Mines," Dr. John W. Finch, director, United States Bureau of Mines, explained the so-called "Strategic Minerals Act"—Public No. 17—passed by the last session of Congress. He said the Act does not authorize loans or grants to owners of deposits of strategic minerals.

"Domestic Sources of Deficient Minerals," a paper prepared by D. F. Hewett, chief, Metalliferous Deposits, United States Geological Survey, was read by H. I. Smith, geologist of the Survey. In it, the author discussed the importance of nickel and tin, two metals produced in negative quantities in the United States. George W. Hallock, president, California Hydraulic Mining Association, reviewed the activities of the hydraulic mining industry and what is being done to overcome stream pollution and thus permit resumption of this type of mining.

After a luncheon at the Newhouse Hotel, during which short talks were made by Governor Blood, Mayor John M. Wallace, Senator William H. King, President Howard I. Young, D. D. Moffat, George H. Rupp, J. W. Wade, R. L. Cox, and others, the afternoon session was opened by Stanly A. Easton, president, Bunker Hill & Sullivan Mining & Concentrating Company. Brief résumés of current status and outlook as to copper, lead, zinc, iron ore, and gold were presented by P. G. Beckett, vice-president, Phelps Dodge Corporation; Andrew Fletcher, vice-president and treasurer, St. Joseph Lead Company; E. H. Snyder, general manager, Combined Metals Reduction Company; R. C. Allen, president, Lake Superior Iron Ore Association, and M. E. Shoup, president, Golden Cycle Corporation.

The chief speech during the afternoon session was delivered by Senator Key Pittman. He declared that the sole authority of Congress to change the price of silver had created a situation whereby it will be impossible to reduce the present domestic price of 71.11c. The Senator predicted a fight for a silver price of $1.29 per ounce at the next session of Congress.

On Tuesday, advances in mining and milling were discussed, together with the fiscal situation and the Wagner Act. Excellent and up-to-date reviews on improved practices and new equipment developed were read by Lucien Eaton, consulting mining engineer, Milton, Mass., and Dean A. W. Fahrenwald of the School of Mines, University of Idaho. H. M. Lavender, general manager, Phelps Dodge Corporation, gave an interesting talk on the Morenci pit, now in progress of development. Guy N. Bjorge, general manager, Homestake Mining Company, presided.

At the afternoon session, J. C. Kinnear, general manager, Nevada Mines, Nevada Consolidated Copper Corporation, was in the chair. D. A. Callahan forcefully pointed out the dangerous premises upon which the Wagner act rests, especially as it ignores established principles of Anglo-Saxon jurisprudence and does not give equal and impartial treatment to employers and employees. He objected to members of the labor board being motivated by the philosophy that the relationship between employer and employee must necessarily be one of conflict, and asked that the spreading of class hatred be stopped. His closing words were, "I believe in organized labor and the right of collective bargaining. I denounce any attempt on the part of management to coerce employees or to prevent them from joining any labor group which they feel will benefit them. I denounce it espionage as unfair and believe that it is a fruitful cause of labor unrest and lack of confidence in management. I believe that the great majority of mine operators subscribe to these views."

Health problems in mining were discussed at the Wednesday morning session over which F. S. Mulock, vice-president and general manager of Western Operations, United States Smelting, Refining & Mining Company, presided. In his paper, "A Critical Review of Occupational Disease Legislation," Theodore C. Waters, attorney, Baltimore, Md., analyzed occupational disease legislation as in force in different States, pointing out faults and virtues of the types of law now in operation. The second speaker, Dr. Leroy U. Gardner, director of the Saranac Laboratory, exploded several popular beliefs about silicosis, stating that the disease, unaccompanied by infection, is not necessarily disabling, and that a positive cure for established silicosis does not appear in the realm of possibility.

The afternoon session was devoted to tariff questions and mine financing, with J. F. McCarthy, president, Hecla Mining Company, presiding. The two principal papers read were, "Experience Under the Reciprocal Trade Agreements," by E. B. Brossard, member United States Tariff Commission, and "Financing of Primary Mining Ventures," by Carl Trauerman, president, Ruby Gulch Mining Company. Particular objection was raised by members to the recent reduction of the duty on zinc. Stability in the zinc industry, new developments, and maintenance of current wages can be maintained only through adequate tariff protection, they stated. The speakers included President Howard I. Young, and Evan Just, secretary, Tri-State Zinc & Lead Ore Producers Association.

The Thursday sessions were given over to discussion of taxation and the Wage-Hour Act as it applies to mining. H. B. Fernald, chairman, Executive Tax Committee, American Mining Congress, presided over the morning meeting. Norman L. McLaren, whose subject was "The 1939 Revenue Act and Western Mining," urged simplification of the tax laws, a greater degree of permanency in tax policies, and greater discretionary powers for the Commissioner of Internal Revenue. "Trend of Federal Taxation" was the title of the paper read by Thomas N. Tarleau, legislative counsel, United States Treasury Department. W. H. Hoover, chief Western counsel, Anaconda Copper Mining Company, presented his paper "Economic Effect of Present Taxes on the Mining Industry."

During the afternoon session the Wage-Hour Act was discussed, with D. M. Kelly, vice-president, Anaconda Copper Mining Company, in the chair. Elmer F. Andrews, administrator, was to have delivered his address, "Application of the Wage-Hour Act to Mining," in person, but was prevented from doing so because of sickness in the family. W. O. Ash, Western director, read a prepared paper in his stead. All members entering discussion agreed that the hours provisions of the Act are a headache to the industry.

The convention closed with a banquet held in the evening at the Utah Hotel at which Senator Key Pittman delivered the principal address. Brief remarks were made by President Howard I. Young, L. S. Cates, president, Phelps Dodge Corporation, and others. James Ivers, governor, Utah Chapter, American Mining Congress, acted as toastmaster.

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MONTANA

Strategic Mineral Deposits to Be Studied

W.P.A. survey to be conducted—Gold dredge being erected near Bearmouth

▶ A W.P.A. mineral survey in Montana sponsored by the Montana School of Mines and the Montana Bureau of Mines will soon get under way. A study will be made of the manganese, tungsten, and chrome resources of the State.

▶ The Star Pointer Exploration Company has begun construction of a dredging unit near Bearmouth just north of United States Highway No. 10.

▶ The fifth annual convention of the Mining Association of Montana was held at Bozeman on Aug. 18-19. The meetings were well attended, and speakers included Mayor August H. Lake of Bozeman, Carl Trauerman, president of the organization, Butte; Julian D. Conover, Washington, D. C., secretary-manager of the American Mining Congress; Dr. A. L. Strand, president of Montana State College, of Bozeman; August Grunert, of Butte; O. I. Deschon, of Great Falls; the Hon. Judge James F. O'Connor, of Livingston, Congressman from the Second District; Dr. F. A. Thomson, of Butte, president of the Montana School of Mines; the Hon. Dr. Thorkelson, of Butte, Congressman from the First District; Robert L. Palmer, of Denver, secretary Colorado Mining Association, and Harry C. Bacorn, vice-president of the Montana Association.

▶ Correction—In the July issue, on page 72, it was inferred that the Broadway mine of the Victoria Mines, Inc., was under the control of the Two Percent mine at Philipsburg. The properties of the Victoria Mines, Inc., consist of the Broadway, Victoria and other claims. John T. Potts, 228 South West Temple St., Salt Lake City, is president; Sherman H. Hinckly, manager; and Alvin V. Taylor, secretary. Operations of the company are reported progressing satisfactorily.

TRI-STATE

Concentrate Price Differential Removed

Smelters now accept flotation zinc concentrates on same basis as mill grades —Metal production from district virtually unchanged

▶ The smelters have at last recognized the inequity of continuing the differential of $1 per ton on zinc flotation concentrates below the price paid for mill grades. On Aug. 12 the differential was removed, and all zinc concentrates now receive the same base price on the Joplin market. The operators of tailings re-treatment mills will be the chief beneficiaries of this change, for 65 to 100 per cent of their product is of flotation grade. When flotation concentrates were first introduced in this district a differential was in order, for the grade of these concentrates was very low and practically none of the smelters serving the district were equipped to handle this type of material. Today flotation concentrates higher than mill grades can readily be produced and practically all smelters serving the district are equipped with sintering machines.

▶ The Atlas Milling Company reopened its tailings re-treatment plant employing 38 men on Sept. 1, according to R. O. Gibson, company superintendent. Tailings from the Beck No. 1 mill, one-half mile to the north, will be re-treated.

▶ The United Zinc Smelting Corporation reopened its Royal (custom) mill the middle of August, after a month's shutdown. D. G. Harrison is district manager for the company.

▶ The recent upswing in metal and concentrate prices has had little effect on the production of the Tri-State district. In the opinion of many operators, zinc concentrates must reach at least $35 per ton before the low-grade mines can be brought back into production.

MICHIGAN

Isle Royale Considers Development Program

Company's semi-annual report indicates improvement—Copper Range also reports better position during first six months of year

▶ Earnings of the Copper Range company for the first six months of this year were substantially the same as for the twelve months last year—in excess of $150,000—according to F. Ward Paine, of Boston, treasurer of the company, who recently spent a week in the district visiting the various properties. Mr. Paine also is treasurer of the Isle Royale Copper Company. Copper Range production during the first half of 1939 was off from the 1938 record not quite 10 per cent, and costs were up about 10 per cent. Inasmuch as mining costs were about 10½c. per pound, the company showed some operating loss, before depreciation and depletion. Costs in July, however, were better, and the selling price of the metal was better, so a slight operating profit was shown for that month. Earnings for the first six months of this year came from the company's fabricating plant (C. G. Hussey & Company) at Pittsburgh. The Hussey company is using the greater part of the copper output of Copper Range and most of the Isle Royale metal that is not refined for silver. About 20 per cent of Isle Royale's production is refined for its silver content. Mr. Paine stated that though the Copper Range company was involved in lawsuits following the acquisition of the Hussey company, which passed through various Pennsylvania courts and reached the supreme court of the State, the company has received several uniform-

ly favorable verdicts. Another encouraging factor in the company's affairs is the fact that it has no bank loans or indebtedness maturing before February, 1942 (incurred upon taking over the Hussey plant) which it cannot meet.

▶ According to the semi-annual report issued by the Isle Royale Copper Company, conditions at the mine have shown satisfactory improvement. Production in May and June showed 50 per cent increase over that of January and February, with a substantial reduction in cost per pound. The average mining cost per pound of refined copper for the first three months was 9.884c., and for the second three months 8,158c. The average cost per pound for the six months was 9,858c., including mining, smelting, freight, and selling costs. The present program of the Isle Royale company consists of working out available ore reserves. The mine is in position to operate for several years without additional openings, but has a relatively short life if stoping only is done. Efforts are being made to enlist outside aid to permit a program of development work to extend the life of the mine. The company is in definitely better financial position than at the close of last year.

▶ Calumet & Hecla is still engaged in exploratory work in Michigan Mining Company lands in Ontonagon County. Drifting and drilling are proceeding in the old Caledonia adit. Some drilling also is being done in old Adventure lands.

IRON COUNTRY

Production at Mines Steadily Increasing

Operators plan for greater output as rate of steel production holds above 60 per cent of capacity—Republic Steel Corporation leases property in New York State

▶ Several independent mining companies have increased their schedules, and producers believe a 40,000,000-ton year is in prospect. Producers cannot at this time very well appraise the effects on their production schedules of the war in Europe, but preparations are under way for greater output.

▶ Charleson Iron Mining Company, of which E. F. Remer, of Hibbing, Minn., is president, has started operations at the Judd mine, at Taconite, Minn., and Pacific mine, at Aurora, Minn. These properties have been idle all year, and they expect to operate until the close of the iron-ore season.

▶ Republic Steel Corporation announced late in July that a 25-year lease had been obtained from the Chateaugay Mining Company for the operation of that company's property at Lyon Mountain, Clinton County, N. Y. J. R. Linney, vice-president of the Chateaugay Company, will continue in charge of operations. A new large iron-ore concentrating plant is under construction at Port Henry, N. Y., and operations are expected to begin early in 1940.

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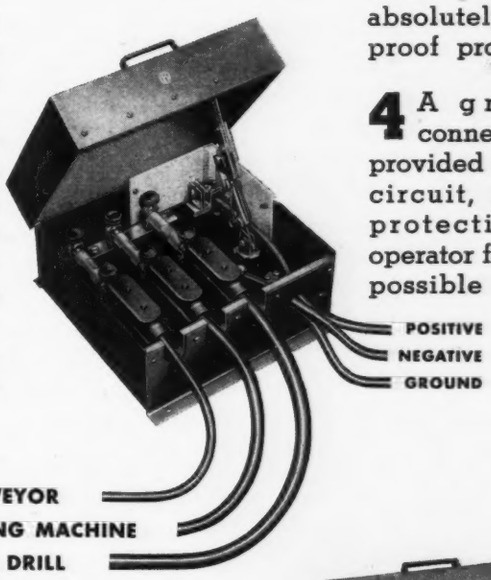

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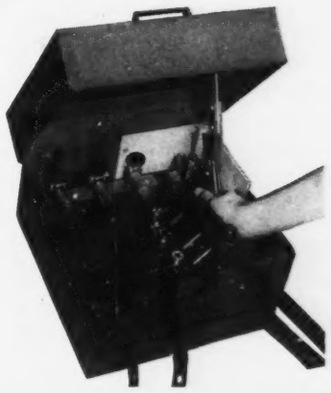

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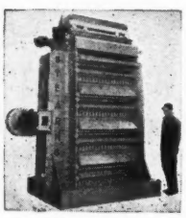

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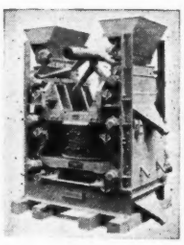

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CANADA

Box Mine Pours First Gold Brick

Announcement is made that the large deposit so far developed averages $2 per ton—New vein discovered on Thompson-Lundmark property

▶ On Aug. 15 officials of Consolidated Mining & Smelting Company attended the ceremony that marked the pouring of the first gold brick, valued at about $30,000, at the Box mine, near Goldfields, Saskatchewan, on Lake Athabaska. Developed at a reputed cost of $4,000,000, ore expectations had been based on a grade of $4.80 per ton. James Buchanan, general superintendent, read a statement from the president, S. G. Blaylock, referring to the grade actually developed, which was about $2 a ton. To pay operating costs, he said, the Box mine would have to be the most efficient in Canada, with a higher recovery than any other mine in the world. Members of the Consolidated Smelters organization directly concerned with the large-scale Box operations include W. G. Jewitt, general superintendent of Northern properties; P. T. Bloomer, mine superintendent; and Paul Elliott, mill superintendent at the Box; and Stanley Gray, engineer in charge of Northern construction. The mine is 465 miles by air north of the railroad at Prince Albert, Sask.

▶ Eldorado Gold Mines, silver-radium producer at Great Bear Lake, Northwest Territories, reports shaft sinking completed to a depth of 1,000 ft. Three veins have been undergoing exploration, and new favorable zones have been found on the 340 and 590 levels, as reported by the president, Gilbert Labine.

▶ E. V. Neelands, consulting engineer directing work at Thompson Lundmark Gold Mines, states that a sound mining position is being established before considering production. A shaft 325 ft. deep has been sunk on the Kim vein and more than 1,000 ft. of lateral work completed. The mineralized zone has an indicated width averaging 4.6 ft. On surface the length is 450 ft. with cut grade of 0.773 oz. On the first level at 150 ft. the length is proved for 255 ft. to give a cut grade of 0.86 oz. A cut grade of 0.907 oz. shows on the 300-ft. level for a length of 105 ft. These values are expected to be reduced by dilution, although special mining methods and sorting will partly offset this factor. The Fraser vein, discovered this summer, has an indicated surface length of 540 ft. and the Island vein has been traced for 100 ft.

Ontario

▶ The 100-ton roaster under construction at Hard Rock Gold Mines is scheduled for operation in September. The present 300-ton mill provides about 75 tons of concentrates daily.

▶ Official approval has been given to the program at Gold Eagle Gold Mines for deepening the main winze from 700 to 1,000 ft. This decision has followed encouraging drill intersections at the lower horizon in No. 1 shear zone, on McKenzie Island, Red Lake area.

▶ Ore reserves at Buffalo Ankerite Gold Mines increased 134,601 tons, to 628,741 tons, in the first half of the year, according to a statement from the president, E. G. Kinkel. A substantial block of the new ore is below the 1,050 level, where a single cut-and-fill stope has been yielding up to 600 tons daily since last summer.

Quebec

▶ Block caving is being used at East Malartic Mines for the first time in northwestern Quebec, following a program laid out by Futterer and Reid, consulting engineers. Backfill is provided by gravel that is poured in on top of a timber mat resting on the ore body.

British Columbia

▶ Exploration is proceeding actively in the new Bedwell River camp, on the west coast of Vancouver Island. Anglo-Huronian, Ltd., of Toronto, and Pioneer Gold Mines, of Vancouver, have formed a subsidiary company, Musketeer Mines, Ltd., with the object of developing their joint holdings in this region. Alfred E. Bull is president. Dr. Howard T. James is managing director, and Franc Joubin is geologist. Pioneer Gold Mines has also taken options on the Casino, Corsair and Mercury groups, 15 miles up Bedwell River from the sea.

▶ A newly formed private company, Buccaneer Mines, Ltd., is doing exploration work on claims adjoining the Musketeer. Open cutting over a length of 440 ft. and a range of 163 ft. in elevation has disclosed a vein which samples 3.40 oz. over a width of 0.432 ft., corresponding to 0.52 oz. over a stoping width of 3 ft.

▶ At Zeballos, 60 miles up the west coast of Vancouver Island from Bedwell River, Reno Gold Mines will build a 25-ton mill at its Central Zeballos property this fall. The Provincial Government is building a road into the mine from the main trunk road.

▶ A progress report issued by D. S. Tait, president of Privateer Mine, Ltd., Zeballos, estimates the available ore in the main vein above the 1,100 level at 61,616 tons, of an average grade of 0.79 oz. across a stoping width of 3 ft.

▶ In the Alberni district, approximately 100 miles south of Zeballos, Havilah Gold Mines has an interesting prospect under development. Officials consider that ore having a gross value of about $110,000 has been indicated at three levels. In the same area United Prospectors, Ltd., have obtained promising results on the Thistle property, where a substantial body of gold-copper ore is indicated by surface workings.

▶ B. R. X. (1935) Consolidated Mines, also operating in this district, is experimenting with the object of discovering the most suitable metallurgical treatment for its complex orebodies.

MEXICO

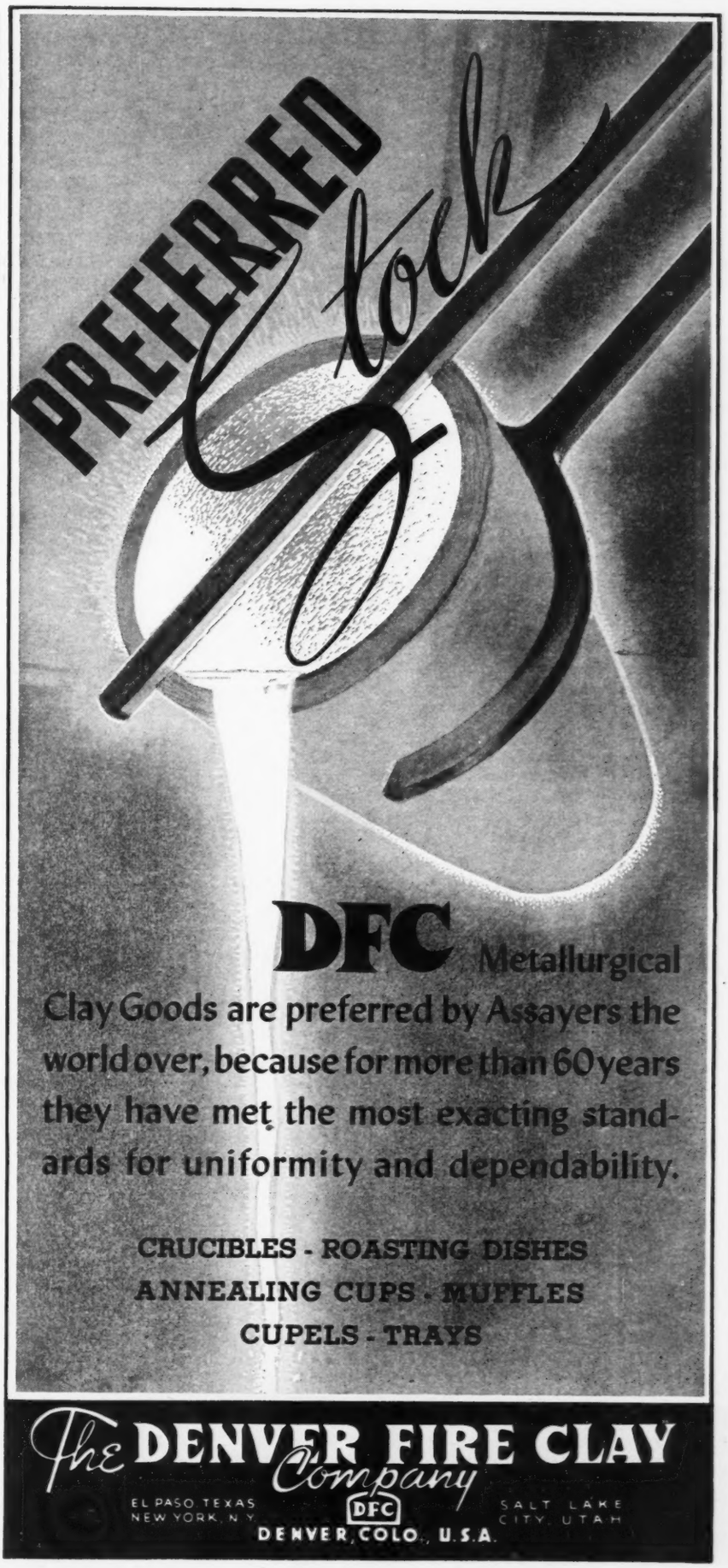
Mining Industry Protests Against Valuations

New appraisals made on metals for export tax burdens all operators — Government erects two mills for small scale miners

▶ Protests to the Ministry of Finance have been made by representative members of the Mexican mining industry against new valuations of exportable metals and minerals for the purpose of levying the 12 per cent tax on shipments made abroad. These mining men contend that though the new valuations exempt silver from the export tax, the new appraisements have been raised so high on other mining products that the whole industry is put at a disadvantage. These mining men have asked for an interview with Lic. Eduardo Suarez, of the finance ministry, at which they intend to point out their plight. The higher appraisements, together with production taxes, it is estimated, will increase the industry's annual expenses from these sources to about 83,000,000 pesos (some $13,500,000). Up to the time Washington changed the rate for buying silver, this yearly outlay was 75,000,000 pesos. Since the change in the silver price it had been 78,000,000 pesos. Based upon silver exports last year of about 81,000,000 oz., producers estimate a net annual loss to this branch of the industry of around $5,000,000. Total taxes on silver have been cut by about one-third. But the new appraisements mean increases of the following percentages on other major metals: Gold: 15; copper: 147; lead: 127, and zinc: 47.

▶ Sanction to discharge employees who have become surplus and a costly payroll item has been asked by Mexican Zinc, Nueva Rosita, Coahuila, of the Federal Labor Department and the national miners union. These employees served in the two zinc batteries that had to be shut because of the lack of concentrates. Their transfer to other units has developed expensively, the company says. Lack of water because of drought in the region is hindering operations of this company.

▶ Approval has been given by President Cardenas of plans presented by the national commission for stimulation of the mining industry for establishment in Guanajuato of a Federal iron foundry which is to produce between 300 and 500 tons daily and to cost 31,950,000 pesos (approximately $6,300,000). The commission expects that this plant will be able to reduce considerably imports of iron and its products which now total some 100,000,000 pesos worth a year. Federal technicians are to start selecting a site for the plant in September. Work on it is to commence in the fall. The commission is completing construction of two treatment plants for prospectors and other small-scale miners. The larger 60-ton daily capacity, is at Mineral de Tlalpujahua, Michoacan. The other of 30 tons daily, is at Teamachalco, near Lomas de Chapultepec, Mexico City.


PREFERRED Stock
DFC Metallurgical
Clay Goods are preferred by Assayers the world over, because for more than 60 years they have met the most exacting standards for uniformity and dependability.
CRUCIBLES - ROASTING DISHES
ANNEALING CUPS - MUFFLES
CUPELS - TRAYS
The DENVER FIRE CLAY Company
EL PASO TEXAS
NEW YORK, N.Y.
DFC
SALT LAKE CITY, UTAH
DENVER, COLO., U.S.A.

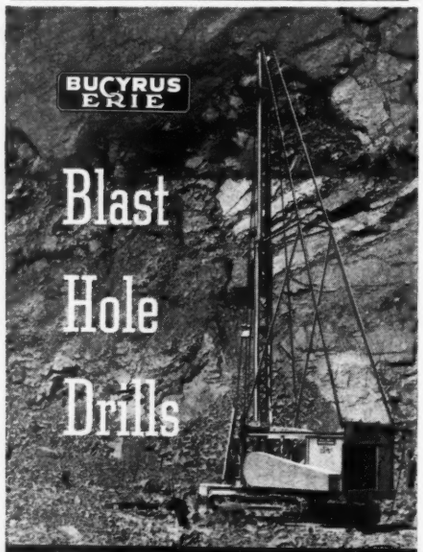
TRI-VIBE

Leahy HEAVY DUTY
Vibrating SCREEN

Like the triple play that cinches the game, the triple powered free-swinging screen jacket . . . which is the new TRI-VIBE feature . . . makes the LEAHY Type "C" No-Blind Vibrating Screen an easy winner in *fine screening* operations. It is dynamic Leahy differential vibration at its best . . . insuring increased capacity and uniformity.

Bulletin No. 14-H will be sent on request.

The Deister Concentrator Company
The Original Deister Co., Est. 1906
903 Glasgow Ave., Ft. Wayne, Ind.



YOU WILL save money on blast hole drilling costs in your open pit mine with up-to-date, efficient Bucyrus-Erie blast hole drills. These drills — the 27-T, 29-T, and 42-T — are the hardest hitting drills you can buy . . they will drill larger holes faster than smaller holes were ever drilled before.

Write TODAY for complete information about the Bucyrus-Erie line of blast hole and prospecting drills.

BUCYRUS-ERIE
SOUTH MILWAUKEE, WIS.

AFRICA

Rand Gold Output Continues at High Rate

Production of more than 1,000,000 oz. per month being maintained—Rhodesian copper producers raise output

▶ The Witwatersrand produced 1,080,741 oz. of gold in July. This compares with 1,064,284 oz. in June, and with 1,083,843 oz. in May, which was a high record of all time. The value of the July output was £7,997,483, computed at 148s per ounce. Somewhat fewer natives are employed than a few months ago, this being the time of seasonal shrinkage.

▶ No. 1 shaft of the Blyvooruitzicht, on the far western Witwatersrand, which was flooded June 30 by an influx of water at a depth of 1,396 ft., has now been successfully dewatered and sinking is proceeding. It has about 3,600 ft. altogether to go in water-impregnated dolomite, and expects to cut the reef at a depth of 4,500 ft. Cementation is being employed.

▶ Rhokana Corporation has published its estimate of earnings for the year ended June 30. Its profit is approximately £1,890,000 after all charges including debenture interest, depreciation, development reserve, and contribution to mine provident fund.

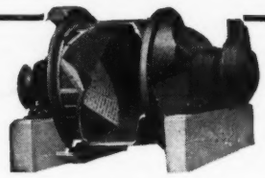
▶ On Aug. 16 Rhodesian copper producers increased production quotas to 105 per cent of capacity. The European war is expected to change this basis soon.

Japan—Japanese interests represented by Nihon Kogyo Kabushiki Kaisha, have made an offer of $8,174,000 for the mining properties in Chosen, Korea, of the Oriental Consolidated Mining Company. The directors of the latter have accepted the offer, contingent upon 60 per cent of the shareholders approving. Payment is to be made in dollars in New York, this overcoming the difficulty due to instability of currencies. Oriental Consolidated has been paying dividends for 36 years, and the price being paid by the Japanese indicates that its properties are exceptionally valuable.

India—Report of the Indian Geological Survey for 1938, just published, states that valuable deposits of coal, iron, and gold have been discovered in India. A seam in the Langrin area of Assam is said to contain 80,000,000 tons of coal, and in Bastar State 610,000,000 tons of iron ore occurs in a single deposit which is rich enough to be worked economically.

Yugoslavia—The productive activities of Trepca Mines, Ltd., have been interrupted temporarily by labor troubles. July output was about two-thirds of capacity.

WILLIAMSON MILLS



OPERATION RECORDS

● SHOW why Williamson Mills are recognized the world over for their low cost of operation and high grinding efficiency. These records show over 20% saving in grinding cost including less power, less ball and less liner consumption per ton of ore ground. The saving is due to increased ball action, low drum speed—prevention of slippage and losses caused by slippage—sturdy reliable construction.

"It's the shape of the drum that does it"

Standard sizes 3½′ to 10½′ diameter, with grate or overflow discharge.

SEND for particulars and let our many years' experience help you with your grinding problems.

WILLIAMSON COMPANY
582 Market St. San Francisco, Calif.

DUST PROTECTION FOR YOUR MINERS

SAFETY plus COMFORT

PULMOSAN D-4100 DUST RESPIRATOR

Approved by U. S. Bureau of Mines

The D-4100 Dust Respirator is designed for long-period protection in severe concentrations of fine dusts. It provides safety, comfort, easy breathing, serviceability. It features specially designed double felt filter, aluminum body, patented rubber face cushion, positive exhalation valve, all-rubber headbands. Order a D-4100 for trial. Ask for details and prices.

Pulmosan Safety Equip. Corp.
***Dept. EM*, 176 Johnson St., Brooklyn, N. Y.**

AUSTRALIA

New Gold Discovery Near Yarrambat

Property near Melbourne in early stages of development has wide vein of good ore—Maryborough Gold, N. L., suspends operations for plant changes

▶Interest is increasing in a new gold find at Yarrambat, about 25 miles from Melbourne. A small reef, followed from the surface in an underlay shaft, has opened out to a width of 12 ft. at a depth of 100 ft., and assayed at that point 3 oz. per ton. This mine, the Golden Crown, has been optioned to a Melbourne company, Yellow Boy Gold Development, N.L., which is proceeding with its development.

▶Wattle Gully Gold Mines, N.L., Chewton, reports that the extra ten head of stamps is now working in its mill, making the total 30 head.

▶Maryborough Gold, N.L., a dump retreatment company operating in the Mayborough district which got into difficulties soon after starting up its plant, has resumed work after a shutdown of several months for plant reorganization. The company is now under the technical management of Gold Dumps Pty., Ltd., a subsidiary of Placer Development, Ltd.

▶Wiluna Gold Mines, Ltd., has lately had some encouraging values in the northern part of its leases, where a drive south from the Bulletin lease at the 1,200-ft. level has reached the Happy Jack section, having passed through a length of 100 ft. of ore assaying 5.3 dwt. followed by 70 ft. averaging 7.8 dwt.

▶Metropolitan Mining Company is obtaining some good results in developing its Black Cat mine at Mount Magnet.

▶A rich yield has been obtained from the Two Chinks mine at Morley's Find. 12 cwt. of ore returning 1,727 oz. of gold.

Fiji

▶A dividend of 1s. per share just announced by Loloma (Fiji) Gold Mines, N.L., brings that company's distributions to £247,500 Australian, which, with dividends totaling £237,500 from the Emperor company, makes the total return from Fijian gold mining just half a million pounds in less than four years. Production figures of the two companies for the 52 weeks ended July 12 were as follows:

	Emperor	Loloma
Ore treated, long tons.	178,164	27,767
Production, oz.	52,371	37,254
Grade, dwt. per ton...	5.9	26.8

▶At the Loloma, the main east crosscut from the new Theodore shaft at the No. 3 (324-ft.) level has been commenced and advanced 19 ft. towards the lode. The south drive from the old main shaft at the 224-ft. level continues in good ore, the last 17 ft. of advance to 1,222 ft. assaying 10.8 dwt. over 106 in.

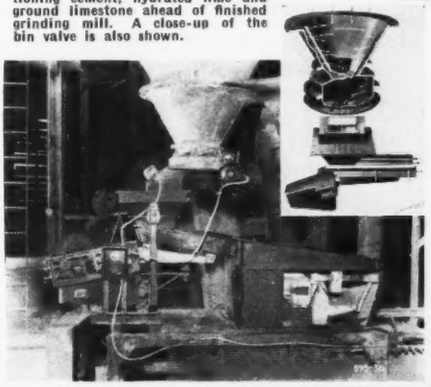
ELECTRIC VIBRATION plus ELECTRIC CONTROL

. . . Two unique factors that "add up" to BETTER, LOWER-COST MATERIALS HANDLING with JEFFREY-TRAYLOR EQUIPMENT

For Instance . . .

MORE EFFICIENT CRUSHING FOLLOWS THIS ALL-ELECTRIC, BIN-CHECKED WEIGH FEEDER

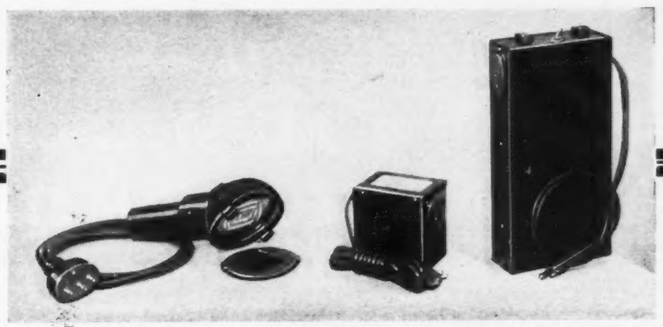
One of three Type 200 Jeffrey-Traylor Waytrols (below) equipped with Rotary Bin Check Valves proportioning cement, hydrated lime and ground limestone ahead of finished grinding mill. A close-up of the bin valve is also shown.



● The more uniform the feed, the more efficient the operation of reduction machinery. That's why the combination of Jeffrey-Traylor weigh feeder and rotary bin valve has proved thoroughly economical in metal mine service. By providing, first, a constant non-flooding head of material fed by high-frequency vibration, which, in turn, is controlled by an 'electric brain' of the Waytrol, an absolutely positive feed for ball mills, etc., is assured. Only J-T screens, conveyors and feeder can give you this positive, accurate control . . . because Jeffrey-Traylor uses a system that is entirely electrical. Let us demonstrate the many advantages of this equipment.

● SEND FOR CATALOG NO. 650-J describing in detail the various applications of Jeffrey-Traylor vibrators.

JEFFREY-TRAYLOR DIVISION
The JEFFREY MANUFACTURING Company
974-99 NORTH FOURTH STREET . . . COLUMBUS, OHIO



MINERALIGHT Lamp Series No. 420

Let MINERALIGHT find your HIDDEN VALUES!

Tungsten producing scheelite and many other ores fluoresce brilliantly in ultra-violet light, yet are difficult to detect in ordinary light. The MINERALIGHT is a powerful source of ultra-violet which causes the pieces of ore to stand out brilliantly, like millions of stars in the night sky. Many mine operators have revealed unsuspected rich deposits of tungsten and other minerals through the use of the MINERALIGHT.

It's so easy to use, too. You just snap a switch, shine the light on the deposit, and the values spring to life as if by magic. It permits not only location, but instantaneously shows the extent and probable quality of the ore. There is a size and style of MINERALIGHT for every need. Don't take chances on overlooking hidden values in your mine.

Write Dept. E-9 today for a bulletin giving complete descriptions and prices.

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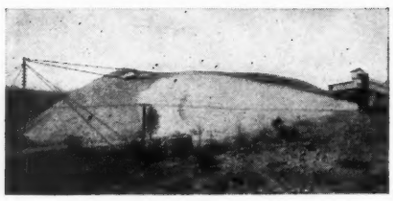
Big Savings . . . IN HANDLING MATERIALS



Above is a simple Sauerman Drag Scraper layout for storing and reclaiming a seasonal surplus of 30,000 tons of screenings at a crushing plant.

At the Gold Road mill, a small Sauerman Slackline Cableway spans an old tailing dump 800 ft. wide and lifts the tailing up to a bin above the floor of the mill.

Open pit mining, storage and reclamation of both raw and processed minerals, and similar work that calls for moving materials distances of 100 ft. or more, are accomplished most economically with Sauerman Cableway or Scraper machines.

A Sauerman machine shows lower costs on these long range material-handling jobs because it digs, hauls, and places the materials in a continuous, straight-line operation, doing away with the expense of rehandling.

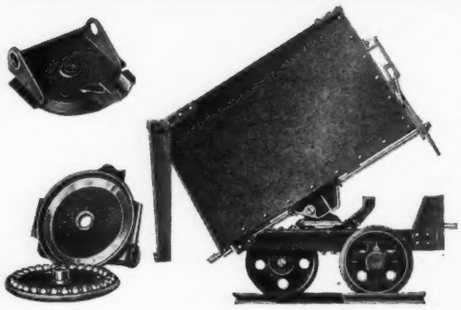
Write for catalog

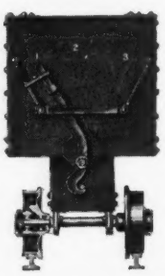
SAUERMAN BROS., INC.
484 S. Clinton St., Chicago

MODERNIZE *with the New* KOPPEL ALL STEEL CAR EQUIPMENT

Designed and built by engineers with years of experience, Koppel All-Around Dump Cars represent just one of the many types and kinds of modern mine cars equipped with anti-friction bearings available for your every need.

The body of this balanced type, all-around dump mine car revolves on a ball-bearing turntable and may be dumped on either side or over the end as shown. Single dump control lever and door lock are conveniently located at end of body as illustrated. Write for descriptive Bulletin on the Koppel line of cars.





Easy turning under load is assured by ball-bearing turntable. Note 3 positions of control lever. In first position body and door are locked—second, body unlocked permitting turning to dumping position. Third, body and door *both* unlocked for dumping.

PRESSED STEEL CAR CO., INC.
(KOPPEL DIVISION)
GRANT BUILDING · PITTSBURGH, PA.

PHILIPPINES

Gold Production Mounts Steadily

Output this year expected to be 12 per cent ahead of 1938—Several new mines start operations

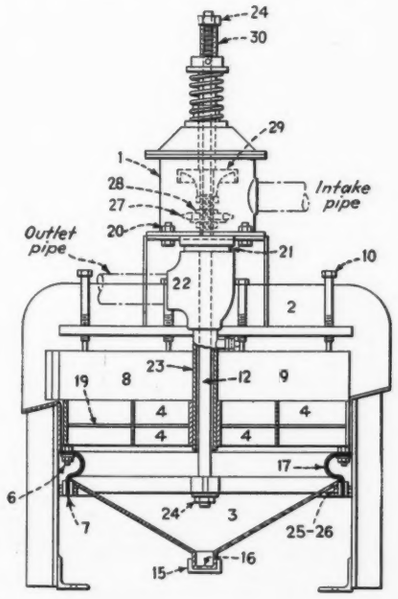
▶ Steadily increasing gold production continues to feature the Philippine mining industry. The output for the first six months of 1939 amounted to $17,600,000, compared to $15,500,000 for the same period in 1938. The monthly production hit an all-time high of $3,118,319 in May, and there is little doubt the average for the rest of the year will equal or slightly better this figure. The 1939 output of the Islands is expected to be in excess of $36,000,000, a 12½ per cent increase over that of 1938. Operating conditions in general continue to be good. Some slight interference with operations in the Baguio district was brought about early in the year by the activities of labor agitators; this situation has been cleared up, however, and no further difficulty is expected.

▶ Among new producers this year is the North Camarines Gold Mining Company that started its 350-ton milling plant in Paracale in February. The plant, which was built by Southwestern Engineering Company of the P. I., is a combination flotation-cyanidation set-up, and treats ore from the Mambulao Consolidated and Paracale National mines in addition to its own product. A 50-ton cyanidation plant was brought into production by the Marsman interests to handle the ore of the Tuba group of the Northern Mining & Development Company, also in the Paracale district. Capsay mine, on Masbate, operated by Mine Operations, Inc., started a 150-ton cyanidation plant in March; plant capacity is now being doubled. Mindanao Mining Company restarted placer mining on its claims in Mindanao in February and is producing gold on a small scale. The Kilometer 73 Mining Company has just brought a small plant in the Surgiao district into production.

▶ An important accomplishment of the industry has been in the development of safety organizations in the Baguio and Paracale districts. The Mine Operators Safety Association, which has its headquarters in Baguio, held its first annual safety celebration in that city on May 1. Contests in first aid, mucking, timbering, and drilling were held, and much interest was shown by the Filipino miners of the district. The report of S. M. Jarrett, director of the Association, covering the first five months of 1939, compared to the same period in 1938, shows that lost-time injuries have been reduced to 16.03 men per million man-hours of exposure for underground work, compared to 30.15 for the same period in 1938. Though the Association is an operators' group, its work is supplemented by that of the governmental Bureau of Mines. Plans are now being carried out for the consolidation of the safety work of the various mines in the Paracale district into an organization similar to that of the Baguio group.

EQUIPMENT NEWS

New Hydromotor Jig



PARTS LIST

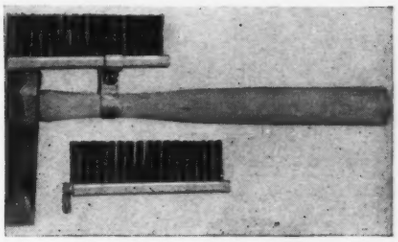
1. Hydromotor
2. Jig frame
3. Plunger
4. Grids
5. Special grid
6. Upper clamp diaphragm
7. Lower clamp diaphragm
8. Side liner discharge end
9. Side liner feed end
10. Grid bolts
11. Grid bar
12. Plunger rod
13. Plunger rod key
14. Plunger rod lock washer
15. Discharge nut
16. Discharge washers
17. Plunger diaphragm
18. Ring washer
19. Screen
20. Hydromotor bolts
21. Hydromotor nipple
22. Hydromotor tee
23. Hydromotor tall pipe
24. Plunger-shaft nut
25. Diaphragm bolts
26. Diaphragm lock washer
27. Pulsator valve
28. Shaft nuts
29. Piston
30. Pulsator shaft

Specifications suggested by the current trend in gold mining and dredging were followed by the Southwestern Engineering Company, 4800 Santa Fe Ave., Los Angeles, Calif., in constructing the new Southwestern-Kraut hydromotor jig. Features are compactness of design; low headroom from feed intake to concentrate discharge; accessibility of parts; absence of moving parts below the hutch; and adjustability of length of stroke, speed, and stroke differential without interruption of operation.

As shown in the accompanying line cut, the new jig consists essentially of a rectangular tank, open on top, within which rests a horizontal screen. To the lower part of the tank is attached a pan plunger by means of a rubber diaphragm. Discharge of concentrates is effected through an opening covered with a rubber washer with an aperture of about ½ in. and held within a short nipple by a removable cup in the center of the sloping pan bottom.

On top of the jig body and supported by a bridge spanning the sides is the hydromotor or aero-motor, which may be operated either by air or water under pressure. The device is said to be of simple construction and consists of a cylinder and a piston rigidly connected to a hollow stem. At the lower end of this stem is a rubber disk or valve held between two metal washers. Connection with the plunger pan of the jig is made by means of a solid rod passing through a pipe under the screen, and spider arms. In this manner the valve motion of the motor is transmitted to the plunger. A spring on top of the motor takes up part of the weight of the mechanism of the jig. An adjustment of the tension of this spring regulates the stroke differential of the valve mechanism of the motor, and with it, the plunger. Water or air is introduced through a pipe connection in the wall of the cylinder. The water discharged through the valve either goes through a vertical pipe under the screen into the hutch, or may be bypassed through a pipe under the motor, if so desired.

The jig is said to be particularly adaptable in dredge and sluice installations, where it is difficult to arrange for ample headroom. Complete absence of any rotating or moving mechanism below the hutch permits considerable freedom for arrangements of concentrate disposal. As the plunger has the shape and area of the screen above, a uniform and even activation of the screen bed is assured, thereby preventing packing of the bed in corners and sides and boiling in other parts of the bed. Adjustment of stroke differential and speed, the upward or pulsion and classifying stroke, can be quickly reduced to a gentle movement, which regulates the velocity of the upward current through the screen and bed to the point where it will prevent the settling of fine gangue particles but will permit the fine heavier mineral particles to settle against the rising current. The suction stroke following the pulsion stroke impels the heavy, settled mineral particles through the bed and through the screen into the hutch. An innovation in the form of a special Southwestern-Kraut grid above the screen in the jig bed provides a means of increasing the ratio of concentration, thereby improving the grade of concentrates produced without affecting recovery.

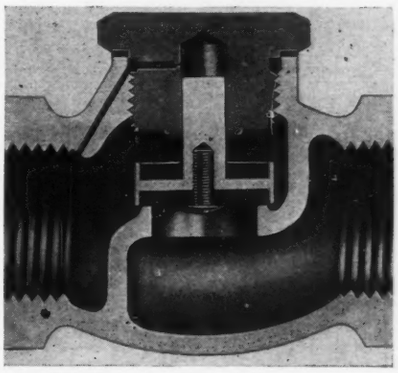


A new tool for the welder is the Triplex welders' chipper, manufactured by St. Pierre Chain Corporation, Worcester, Mass. It has a drop-forged chipping hammer and heavy-duty wire brush mounted on the top side.

Convertible Shovel

A NEW 2-CU.YD. power shovel, the 44-B, is being offered to the excavating industry by Bucyrus-Erie Company, South Milwaukee, Wis. It is available with gasoline, diesel, or electric power and can be converted for use as shovel, dragline, clamshell, or crane.

A new type chain crowd has been incorporated into the new shovel which according to the manufacturer, provides powerful crowd-out and high speed retract, saving time on every digging cycle. Crowd, hoist, and swing are synchronized to give maximum output in all kinds of digging. A light, strong front end affords the user exceptionally wide working ranges; and big sheaves increase rope life and provide favorable digging angles.



C. A. Norgren Company, Inc., Denver, Colo., announces a new check valve that is said to completely eliminate irritating noise and destruction due to valve hammer in airlines.

Bacharach Industrial Instrument Company, Pittsburgh, Pa., announces a new pocket size CO_2 indicator that is said to require about 20 sec. to make an analysis.

DEISTER'S

Latest Improvements In

PLAT-O ORE CONCENTRATING TABLES for concentrating any ore from ¼" to slimes. *Bulletin No. 20B.*

PLAT-O HEAVY DUTY VIBRATING SCREENS for large tonnages ore, sand and gravel, crushed stone, etc. *Bulletin No. 26.*

MULTIRAP VIBRATOR—High speed for fine screening. Non-blinding, high efficiency, long life screen cloth. *Bulletin No. 24.*

COMPOUND FUNNEL CLASSIFIER—Gold trap for coarse gold. Preparation of ore pulps for table concentration. *Bulletin 23.*

DEISTER MACHINE COMPANY

1933 East Wayne Street Ft. Wayne, Ind.

Broderick & Bascom Rope Company, St. Louis Mo., announces the use of 3½-inch rope to replace rods that support this bucket ladder on a Colorado gold dredge.

COMPLETE SAFETY INCLUDES ROPE and CHAIN FITTINGS

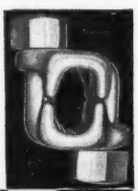
Why insist on new wire rope for extra safety —and anchor it with worn-out, inferior clips, shackles, turnbuckles and sockets? Why renew that chain for safety's sake and neglect the fittings for it?

For that extra factor of safety, *specify*

LAUGHLIN DROP FORGED FITTINGS

Improved design adds strength *with* lightness; improved machinery in our new plant insures utmost precision; experienced craftsmanship and rigid inspection eliminates the menace of hidden weakness. Investigate NOW—by catalog from us, and with orders through your distributor.

Send for FREE SAMPLE of "SAFETY" CLIP (Patented). A radical advance in clip design. TWO Bearing Saddles give 95.4% rope efficiency without crimping and weakening rope. Faster and foolproof because nuts are on opposite sides. Endorsed by leading insurance companies and wire rope manufacturers.

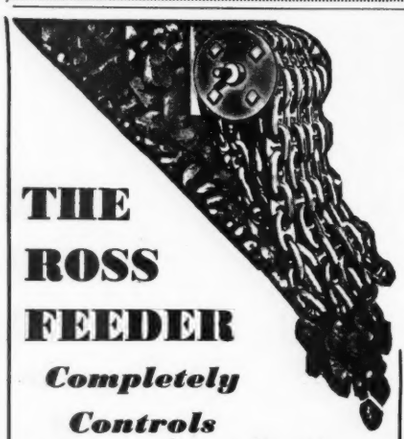


THE THOMAS LAUGHLIN CO.

Manufacturers of Marine and Industrial Hardware Since 1866

PORTLAND · MAINE

Allis-Chalmers Mfg. Company announces a new Type "R" all-steel gyratory crusher said to operate at higher speed than ever used before.



THE ROSS FEEDER

Completely Controls

the flow of any size material from Storage Bins, Hoppers or Open-Dump Chutes to Crushers, Conveyors, Screens, etc.

High in efficiency. Low in maintenance and power consumption.

Furnished in sizes to suit your operation. Scalping unit to fit your chute if desired. Send full particulars for recommendation.

ROSS SCREEN & FEEDER CO.

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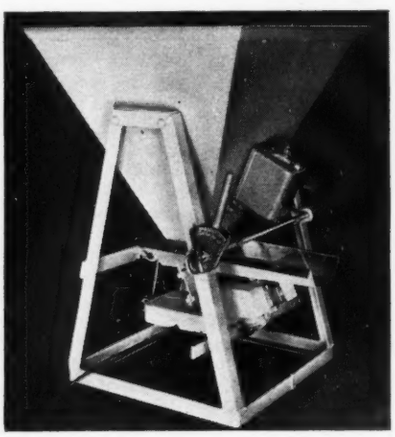

Syntron Company, Homer City,, Pa., has announced a new small-model dry feeder machine having a one cubic foot hopper capacity, that supplies material to a vibratory feeder conveyor trough.

NITROSE

the "one coat" protective covering for metal surfaces.

STOPS CORROSION

from water, acid fumes, alkalies, and extreme temperatures.

AT LESS COST

Saves up to 2/3 of usual preparatory and application costs — gives longer and more complete protection.

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THE NITROSE COMPANY, INC.

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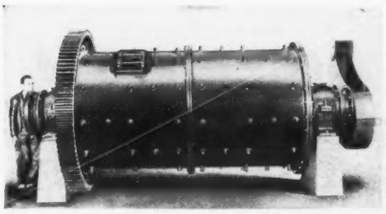

Denver Equipment Co., Denver, Colo., announces a ball mill that can be increased in capacity by adding a unit to the 5-ft. ball mill. The illustration above shows the added portion attached, making the original 5x5 ft. ball mill a 5x10 ft. unit.

INDUSTRIAL NOTES

Carl Lager, president of Morris Machine Works, Baldwinsville, N. Y., and one of the nation's foremost designers of pumping machinery, steam engines, and hydraulic dredges, died at his summer home in the Adirondacks on July 17.

Contracts have been let by Battelle Memorial Institute, Columbus, Ohio, for the construction of a new research laboratory to take care of the expanding volume of industrial research, according to Clyde E. Williams, director. American industrialists are becoming increasingly research-minded, he said, and he predicted that the nation's facilities for research will have to be greatly expanded in the immediate future.

The Department of Mining & Metallurgy, National University of Yunnan, Kunming, China, requests that catalogs, and all types of commercial literature, on all phases of the mining industry, be sent to the above address attention Prof. C. P. Chang, Chairman of the Department.

H. Von Thaden, vice-president of the Robins Conveying Belt Company, has recently returned from an extensive visit in Chile, South America.

Corey C. Brayton, sales engineer American Manganese Steel Company, Oakland, Calif., recently returned from a business trip to Alaska, where he visited a large number of dredging projects.

R. W. McKee has been named acting manager of the Birmingham (Alabama) office of Hercules Powder Company, following the death on Aug. 1 of J. J. Grimes, manager for the last 21 years. **F. George Trescher** has been named acting manager of the San Francisco office of Hercules Powder Company. **J. B. Johnson,** former manager, was recently transferred to the home office at Wilmington as director of purchases.

At a recent meeting of the board of directors of the Goodman Manufacturing Company, Chicago, Ill., William E. Goodman was elected president of the company to fill the vacancy caused by the death on May 15, 1939, of Charles H. Strawbridge. **Loyal F. Crawford** and **Arthur C. Green,** sales manager, were elected vice-presidents.

Hans Lundberg, Ltd., of Toronto, geophysicists and geologists, announce the opening of a United States subsidiary company in New York. The American company is Hans Lundberg, Inc.

The John A. Roebling's Sons Company of Trenton, New Jersey, announces the appointment of Earl N. Graf as manager of its Pittsburgh, Pa., Branch located at 855 West North Avenue.

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BULLETINS

Motor Equipment. Ideal Commutator Dresser Co., Sycamore, Ill. Catalog J-239 describes motor and other maintenance equipment and electrical supplies. Electrical engineering data and other useful information are also given. Pp. 84.

Mining Machinery. David Cole, Mills Building, El Paso, Tex. Bulletin 102 describes and illustrates crushing and grinding equipment for the small mine operator. Data on muleback power plants is also included. Pp. 10.

Magnet Wire. Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y. C-352, Second Edition, describes and illustrates the manufacturer's magnet wire and coils for every type of service; pp. 92. A small pocket-size technical information booklet accompanies this edition; pp. 40. **Insulated Power Cable.** C-42 describes applications, physical and electrical properties of the manufacturer's rubber power cables; pp. 53.

Pulverizers and Crushers. Jeffrey Manufacturing Co., Columbus, Ohio. Catalog 710 describes and illustrates the manufacturer's types of swing-hammer pulverizers and crushers. Pp. 31.

Detachable Bit Furnaces. Lindberg Engineering Co., 221 North Laflin St., Chicago, Ill. Folder describes a rotary hearth furnace for heat-treating detachable bits. Pp. 2.

Continuous Vacuum Filters. Eimco Corporation, 634-666 South Fourth West St., Salt Lake City, Utah. Bulletin 402 illustrates and describes general principle of the manufacturer's complete drum and disk type of continuous vacuum filter; pp. 27. **Mechanical Loaders.** Bulletin 104 describes features of two new Eimco-Finlay mechanical loaders. Models 12-B and 21; pp. 4.

Vari-Speed Controls. Columbia Vari-Speed Co., Weaton, Ill. Catalog describes and illustrates installations of variable-speed transmission units by the manufacturer. Pp. 8.

Flexible Couplings. Morse Chain Co., Ithaca, N. Y. Bulletin 57 contains data and describes and illustrates application of the manufacturer's complete line of flexible couplings. Pp. 32.

Agitators. Patterson Foundry & Machine Co., East Liverpool, Ohio. Folder describes the new Unipower agitator. Pp. 4.

Hydraulic Coupling. American Blower Corp., 50 West 40th St., New York, N. Y. Bulletin 3219 describes features of traction type hydraulic coupling. Pp. 7.

Ore-Dressing Notes. American Cyanamid Co., 30 Rockefeller Plaza, New York, N. Y. Bulletin No. 9 is entitled "New Depressant for Carbonaceous Gangue in Flotation Pulps." Pp. 8.

Explosion-Proof Motors. Louis Allis Co., Milwaukee, Wis. Bulletin 508-E describes the manufacturer's new line of a.c. and d.c. explosion-proof motors. Pp. 19.

Hydraulic Actuator. W. F. and John Barnes Co., Rockford, Ill. Bulletin VA-100 describes the manufacturer's Multi-Power hydraulic valve actuator for opening and closing valves by manual, automatic, or remote control. Pp. 4.

Refractories. Harbison-Walker Refractories Co., Pittsburgh, Pa. Folder describes various refractory bricks manufactured by the company. Pp. 2.

Bent Tube Boilers. Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y. Catalog BT-6 describes and illustrates two-, three-, and four-drum type boilers, together with numerous setting arrangements. Special designed units ranging from 100,000 to 1,000,000 lb. of steam per hour are also described. Pp. 40.

Welding and Cutting Equipment. Victor Equipment Co., 844 Folsom St., San Francisco, Calif. Bulletin CW 10M describes and profusely illustrates cutting and welding equipment by the manufacturer. Pp. 31.

Combustion Control for Boiler Furnaces. Leeds Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Catalog N-01-163 describes and illustrates features of application of the manufacturer's Metermax combustion control to major type furnaces. Pp. 34.

Cords and Cables. General Cable Corporation, 420 Lexington Ave., New York, N. Y. Folder gives manufacturer's engineering analysis of its Super Service heavy-duty cords and cables. Pp. 4.

Phot-Electric Counting Equipment. Lipman Engineering Co., 415 Van Braam St., Pittsburgh, Pa. Brochure describes the manufacturer's PC-3 high-speed photoelectric counting equipment. Pp. 8.

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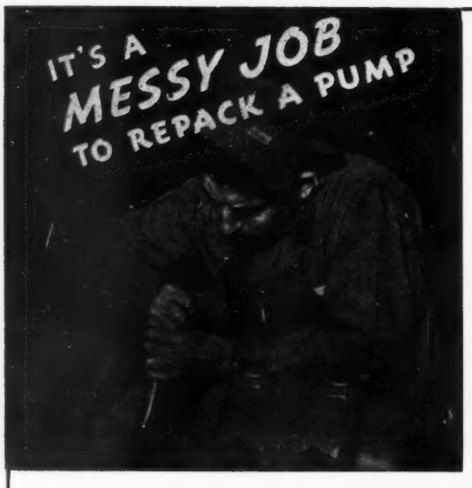

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